World Energy Investment 2026

Under embargo
until 6:00 a.m. Paris time
on Thursday 28 May.

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Executive Summary

Despite the destabilising effect of the Middle East conflict, capital flows to the energy sector are expected to grow to USD 3.4 trillion in 2026, a 5% rise from 2025. Around USD 2.2 trillion is expected to go collectively to renewables, nuclear, grids, storage, low-emissions fuels, efficiency and electrification, and some USD 1.2 trillion to oil, natural gas and coal. Given that the world is facing the largest energy security threat in history, this 11th edition of the annual World Energy Investment report is being released at a time of profound uncertainty for investors and policymakers. As with previous energy shocks, many of the impacts will become visible only later: around three-quarters of anticipated 2026 energy investments are effectively locked in, based on decisions made well before the conflict began. But, no matter how and when this crisis ends, it will leave a lasting mark on energy investment strategies and flows.

Coming so soon after the global energy crisis of 2021-2023, today's conflict is expected to reinforce a strong prioritisation of energy security amongst decision-makers. However, while the previous energy crisis was centred on Europe, following Russia's cuts to pipeline gas deliveries, the effects of today's disruptions are felt most directly in the Middle East itself and in Asia, which had been the destination for 80-90% of energy exports from Gulf producers. Confidence in the reliability of transit through the Strait of Hormuz has been profoundly shaken, and could remain fragile even once a resolution to the immediate conflict is reached. A renewed focus on resilience and diversification will be a widely-shared preoccupation in the wake of the crisis, both among energy exporters and importers.

Recovery in the Middle East will be accompanied by a search for new routes to market

Within the Middle East, the conflict has already sparked a search for new energy export routes to reduce excessive reliance on the Strait. Capital will also be required to repair damaged energy infrastructure. IEA tracking suggests that more than 30 energy facilities in the Middle East have been damaged, either moderately or severely, including refineries, petrochemical plants, upstream oil and gas production sites, and 2 of the 14 liquefaction trains at the huge Ras Laffan LNG complex, which could take several years to repair. Additionally, some 20 tankers have been struck by missiles or drones. The total repair bill is difficult to establish with any precision, but is set to run into tens of billions of dollars. Higher domestic financing needs within the region could reduce outward capital flows, which have been a growing source of finaning for infrastructure and energy projects in other regions.

The conflict has boosted revenues for most oil and gas producers, but also created new uncertainties

The Middle East conflict has thrown oil markets into turmoil, but the short-term guidance from oil companies on their 2026 investment plans has remained largely unchanged. Oil supply

investments are expected to decline for the third year in a row, to less than USD 500 billion in 2026, despite the revenue boost for most producers from higher oil prices. Middle East investments have been revised down because of the conflict, which has dramatically cut export income for producers like Iraq and Kuwait that lack alternatives to the Strait, and delayed some projects. Outside of the Middle East, short-term investment responses are constrained by uncertainty over the duration of the oil price spike, but also by long project cycles, infrastructure bottlenecks, depleted exploration portfolios and tight offshore rig markets.

There are signs that oil companies are recalibrating their expectations for upcoming years, on the assumption that oil prices will settle back above the pre-conflict baseline as countries replenish their inventories. Alongside efforts to restore production capacity across the Middle East, a higher-for-longer price could boost spending on some short-cycle assets, notably US shale. Despite the conflict's potential structural impacts on oil demand, companies are also anticipating renewed interest in longer-cycle projects as countries step up development of domestic oil and gas resources; new offshore capacity in Africa, Asia and Latin America; and onshore projects in Venezuela.

Investment in natural gas supply is set to reach USD 330 billion in 2026 (the highest level in ten years), but the current gas supply crisis – the second in five years – is affecting consumer sentiment among prospective gas importers in Asia. Today's gas supply and infrastructure investments are aimed primarily at meeting domestic demand in resource-rich countries, but there is a sizeable export-driven component in the wave of new LNG export projects, mainly in the United States and Qatar. This surge gained strength in 2025 as more than 100 billion cubic metres (bcm) of additional LNG export capacity was approved, a new record (nearly 90% of it was in the United States). The Middle East crisis has delayed the market-easing effects of LNG investments, and it has also renewed gas supply reliability and affordability concerns among price-sensitive importers.

Fuel-importers look to energy resources available at home

Changing perceptions of risk and reliability are expected to spur renewed interest in a range of domestically available energy resources; for key fuel importers, this creates upside for renewables, nuclear and potentially also for coal. Renewable energy resources are widely distributed around the world, and preliminary signs indicate that deployment is picking up in some markets heavily affected by the energy crisis. Solar panel imports to developing countries in Asia and Africa have jumped in recent months. The Philippines, which declared a national energy emergency in March, was the largest destination for Chinese solar panels among emerging market and developing economies in the first quarter of 2026, at triple the 2025 levels. In Africa, 15 countries reported record-high solar imports of more than USD 400 million in the first quarter of 2026, compared with USD 650 million for the whole of 2025. Households and businesses can insulate themselves in part from energy shocks by installing solar panels and batteries,

especially if they rely on diesel to run small-scale generators. Utility-scale projects take longer to materialise, but some countries are already drawing policy conclusions: Thailand, the Philippines and Viet Nam, for example, have reaffirmed their commitments to develop clean power generation and reduce reliance on imported fuels.

Overall, around USD 665 billion each year is now going into renewable power projects worldwide, including USD 365 billion – USD 1 billion every day – to solar projects. Solar investments are followed by wind at USD 200 billion, and hydropower at USD 75 billion. The overall amounts going to renewable power projects have fallen year-on-year since 2024, following several years of explosive growth, but renewables still account for 70% of total power generation spending. The decline was due in part to falling technology costs, particularly for solar panels, but also to policy changes in China (where project developers are now exposed to greater revenue uncertainty) and the United States (where revised federal permitting rules and incentives are making many new renewables projects riskier). However, other markets – including those most affected by the current crisis in South and Southeast Asia – have witnessed rapid growth in recent years, with the share of total power generation investments from low-emissions sources having risen from around 60% in 2019 to 75% today.

With 78 GW of new nuclear capacity under construction in 15 countries and annual investment now above USD 80 billion, nuclear energy is already making a strong comeback and this could gain further momentum. China's domestic nuclear programme accounts for one-third of global investment, and China and Russia are currently the predominant technology providers: of the nuclear reactors that started construction in the past decade, 94% were of Chinese or Russian design. However, as in the 1970s, today's energy shock could trigger new investments that diversify the technology mix, including in small modular reactors (SMRs). More than 40 countries already have policies in place to support nuclear deployment, reflective of a shift in attitudes towards the technology.

Coal supply investments have been rising and are set to reach USD 180 billion in 2026, the highest level since 2012, with China responsible for nearly 70% of this spending and for almost all approvals of new coal-fired power plants. India is the second largest investor in coal supply, and its investments have tripled over the last decade. The crisis may buttress spending on coal in the main Asian markets, at least in the short term, as countries seek to keep existing coal-fired power assets in the system longer. But it remains to be seen whether spending on new coal plants will increase outside of China, and who will build and finance them.

Investments in low-emissions fuels are set to rise from a low base to around USD 30 billion. While the current crisis may generate some upside benefits for biofuels, especially when they are used in place of imported fuels, these gains could be offset by heightened sensitivity over possible trade-offs with food security. Most low-emissions fuels also require significant policy and financial support, which will be challenging during a time of high fiscal pressure. China continues to push ahead with low-emissions

hydrogen projects at a time when momentum in some other markets is faltering.

A further acceleration towards the Age of Electricity?

If it prompts a faster pace of electrification, the conflict will bring the Age of Electricity even more clearly into view: electricity-related spending already makes up nearly 60% of all global energy investment. Investments in electricity supply and infrastructure are expected to reach USD 1.6 trillion in 2026 and rise to USD 2 trillion when spending on end-use electrification is included. Electric mobility is growing quickly outside some of the main established markets: going into the crisis, electric vehicle (EV) sales in Southeast Asia had more than doubled in 2025 to reach half a million, a sales share of nearly 20%. Some countries (including Viet Nam, the region's largest EV market) have already announced plans to expand or extend EV tax incentives as part of their energy crisis response. Meanwhile, available heat pump sales data for Europe show a 17% year-on-year increase in the first quarter of 2026, despite subsidy scale-backs in certain countries.

In contrast with recent trends, investments in electricity supply are now leaning towards grids and storage. Global spending on networks is expected at around USD 550 billion in 2026, up nearly 20% year-on-year, while spending on batteries for the power sector exceeds USD 100 billion. This is a welcome rebalancing of investment flows. Previous editions of the World Energy Investment have highlighted how grid investments were lagging those for generation, creating electricity security risks. However, a caveat to this apparent improvement is that, while battery costs have continued to decline, the rise in grid investment also results in part from tight supply chains raising the cost of key components such as transformers and cables. Constraints on the speed of grid expansion, including slow permitting in many cases, underscore the importance of investing in smarter and more efficient utilisation of existing infrastructure.

Previous energy shocks have led to step-changes in policy attention to demand-side efficiency. The coverage of energy efficiency policies has broadened over recent years, and around USD 350 billion is invested worldwide each year in efficiency improvements. IEA policy tracking suggests that some 20 countries have already announced new policies to improve efficiency as a result of the crisis. There are plenty of gaps that remain to be filled. For example, around half of countries globally do not have efficiency standards for new buildings, notably in developing countries that are experiencing rapid urbanisation. Similarly, there are still no mandatory energy performance standards for industrial motors in two-thirds of all countries globally.

Investments in renewables, nuclear, electrification and efficiency in the past decade have tangibly improved energy security in major fuel-importing regions and reduced emissions. These investments in five importing regions (China, the European Union, Japan and Korea, Southeast Asia and India) avoided around USD 260 billion in fossil fuel import costs in 2025, and the benefits are set to be considerably larger in 2026. Around one-third of import

savings result from investments in renewables (including bioenergy); another one-third stems from efficiency gains (particularly in transport); around 20% comes from electrification; and the remainder derives from nuclear developments. China had the largest benefits (around USD 110 billion), with electrification playing a larger role.

Data centres and artificial intelligence are major drivers for energy investment trends in some markets

Orders for new natural gas-fired power plants surged to 130 GW in 2025, a 25-year high, with US data centre demand a major factor. Until 2023, most gas-fired power plant approvals were made in gas-importing countries, but now the United States and the Middle East dominate the order books, pushing anticiapted global investment in gas-fired power to nearly USD 120 billion in 2026. Tech sector power demand has had a significant influence on the US rebound in gas-fired investment, including nearly all the USD 28 billion-worth of gas turbines ordered for onsite power generation. Strong US and Middle Eastern demand is limiting the availability of turbines for near-term deployment elsewhere in the world, including in countries the gas industry is looking to as future LNG importers.

Energy investment trends and the availability of reliable, low-cost electricity will help determine which countries lead in artificial intelligence. As electricity demand for data centres continues to grow, the tech sector is becoming a major energy investor, accounting for around 40% of all corporate power purchase agreements signed globally in 2025, and underpinning momentum for emerging technologies such as SMRs and advanced geothermal. Total energy sector investment for the buildout of data centre infrastructure globally in 2025 is estimated at over USD 100 billion, including power equipment and generation (both grid-connected and onsite) and grid upgrades – exceeding the total invested in Africa's energy sector in 2025.

Cost trends and technology learning continue to play a crucial role in determining investment flows

Without the cost reductions of the last ten years, the energy investments anticipated for 2026 would be nearly twice as expensive. The largest cost reductions over this period have been for renewable energy technologies, led by solar, and for batteries, which have dramatically brought down the price of electric mobility and of storage projects in the power sector. Costs for oil and gas developments have also declined, thanks to continued advances in drilling technologies and more use of standardised project designs. Artificial intelligence promises to spur continued cost-efficiency improvements across much of the energy sector.

The Middle East conflict is leaving its mark on financing prospects for energy projects

The Middle East conflict triggered volatility within financial markets, slowing investment decisions in the short-term and pushing up long-term financing costs. After rapid increases in interest rates in 2022, 2025 saw rate reductions or stabilisation in many major economies. The rise in oil prices following the outbreak of the Middle East conflict stoked inflation fears, raising long-term

borrowing costs. The conflict also triggered short-term volatility, most visibly in corporate credit spreads (the extra amount corporate borrowers need to pay above a risk-free benchmark), which caused a slowdown in financing decisions as investors adopted a wait-and-see approach on how conditions might evolve.

If borrowing costs stay higher for longer, capital-intensive technologies will be disproportionately affected, including low-emissions ones that typically have high upfront costs but much lower operating costs than fossil-fuelled alternatives. Financing for renewables has been robust in recent years, despite the downgrading of explicit climate-related commitments by some financial institutions: banks continue to underwrite what they see as a clear strategic growth opportunity. However, a higher interest rate would be challenging for companies operating in clean technology areas, even as broad energy security arguments swing in their favour. By contrast, large oil and gas companies often fund projects off their own-balance sheets, which are supported in the short term by higher prices.

Higher financing costs would also put emerging market and developing economies at a distinct disadvantage, as they already face a much higher cost of capital for energy and other infrastructure projects. Emerging market and developing economies outside of China need to attract additional capital to meet rising demand for energy services: while they accounted for 10% of the growth in energy investment over the past decade, this share rises to more than 50% over the next ten years, according to IEA exploratory scenarios. Companies in these markets are particularly at risk because financing costs are already at least double those of advanced economies and China, and further increases could reduce project returns to below acceptable levels for investors.

Another change for some of the world's largest listed energy companies is the rising ownership role of institutional investors. This includes greater stakes in many of the largest listed state-owned energy companies, where the share of institutional investors – such as pension funds, insurance companies, asset managers, and sovereign wealth funds – in equity has risen from 3% in 2020 to 30% in 2026. The broad trend is linked to the rise in passive investment, with large global asset managers holding a growing share of companies on major listed indexes. The increased presence of institutional investors in state-owned enterprises, in particular, is a notable shift in the relationship between public and private capital. As governments reduce direct ownership, they become more exposed to market and investor expectations. The balance between national interests and shareholder returns is therefore becoming more complex, especially in periods of market volatility.

Strategic investment choices for energy and R&D have important implications for geopolitics, trade and affordability

A more electrified energy system can meet multiple policy goals, and reduce fuel import dependence, but it can also bring new supply chain dependencies that need to be addressed. China accounted for around 75% of total clean energy manufacturing investment in 2025, including 80% of the production supply chain

capacity for lithium-ion batteries and 95% for PV wafers. Meanwhile, investment in critical minerals fell in 2025 for both extraction and exploration, following several years of rapid growth; projects that help diversify supply are particularly vulnerable to cyclical pressures and financing constraints.

Greater attention to energy security is a widely-anticipated outcome of today's conflict, but this will entail additional costs and potential trade-offs with affordability. Building alternative routes to market, strengthening supply chains, allowing for greater redundancy and lower utilisation rates for back-up infrastructure, and investing in inventories and other buffers all make the energy system more secure, but also more expensive. With sources of public funding for energy projects increasingly scarce, the cost-efficiency of energy security measures is set to become a key element in energy debates.

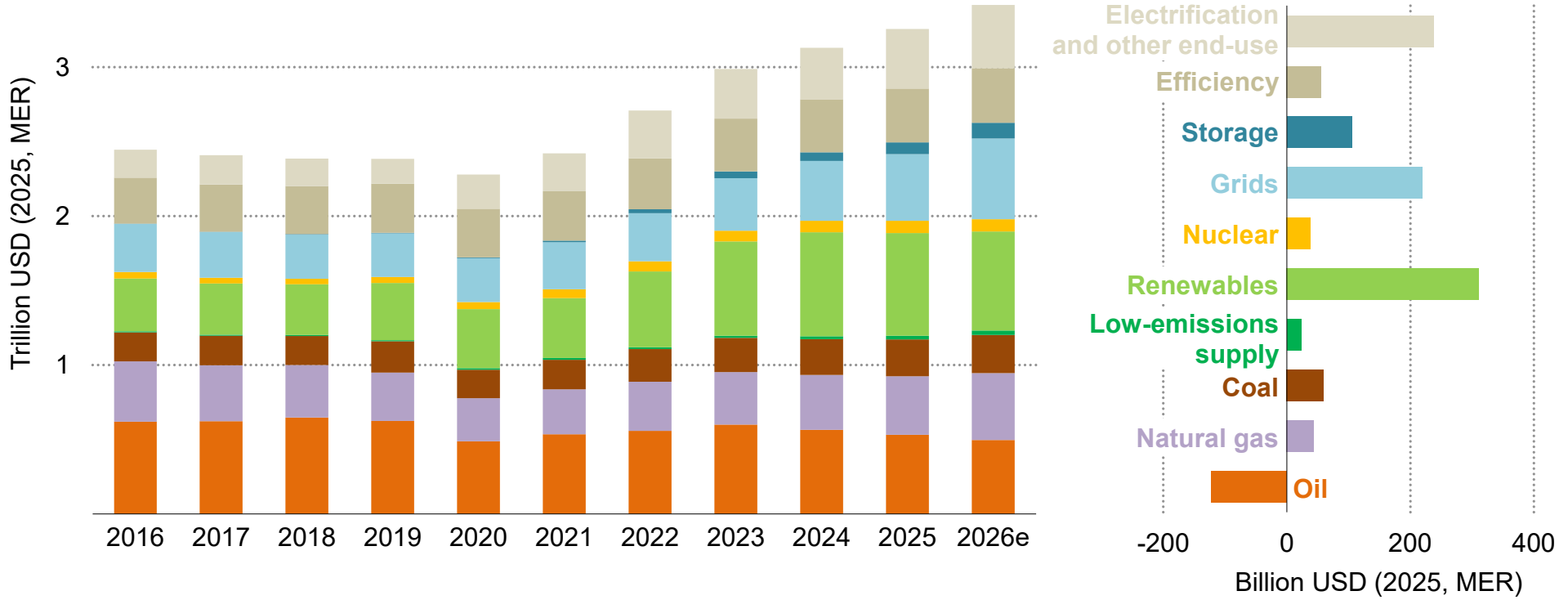
The oil shocks in the 1970s led to explosive growth in public and corporate spending on R&D and innovation, the effects of which are still being felt. A repeat performance today would have a huge influence on future energy trends, although energy is now competing with other innovation priorities in AI and defence. Spending on public energy R&D by IEA members reached 0.1% of their GDP in the 1980s, but it is far below this level today. The United States, Europe and Japan, among others, remain major supporters of energy innovation, but China now accounts for over one-third of global public investment in energy R&D, and its share of corporate R&D spending in energy-related sectors has risen to above 40% of the global total - double what it was in 2015. But while China is increasingly present in global public and corporate energy R&D spending, the United States remains the global hub for venture capital deals to scale innovations.

A transformative moment for world energy investment

The Middle East conflict is reinforcing a shift towards security, trust and diversity as key considerations when choosing energy projects and partners, alongside costs, prices, and environmental performance. This will have wide-ranging implications for the fuels and technologies that countries prioritise, where they get them from, and how they look to achieve other strategic energy objectives, including energy transition and climate goals. The conflict is not over, and the precise contours of this new energy investment landscape will become clear only over time. But the way that global oil and gas supply – and large parts of the global economy – can be disrupted by blocking a 50-km wide waterway will not be quickly forgotten.

Energy investment rises to USD 3.4 trillion amid economic and geopolitical uncertainties

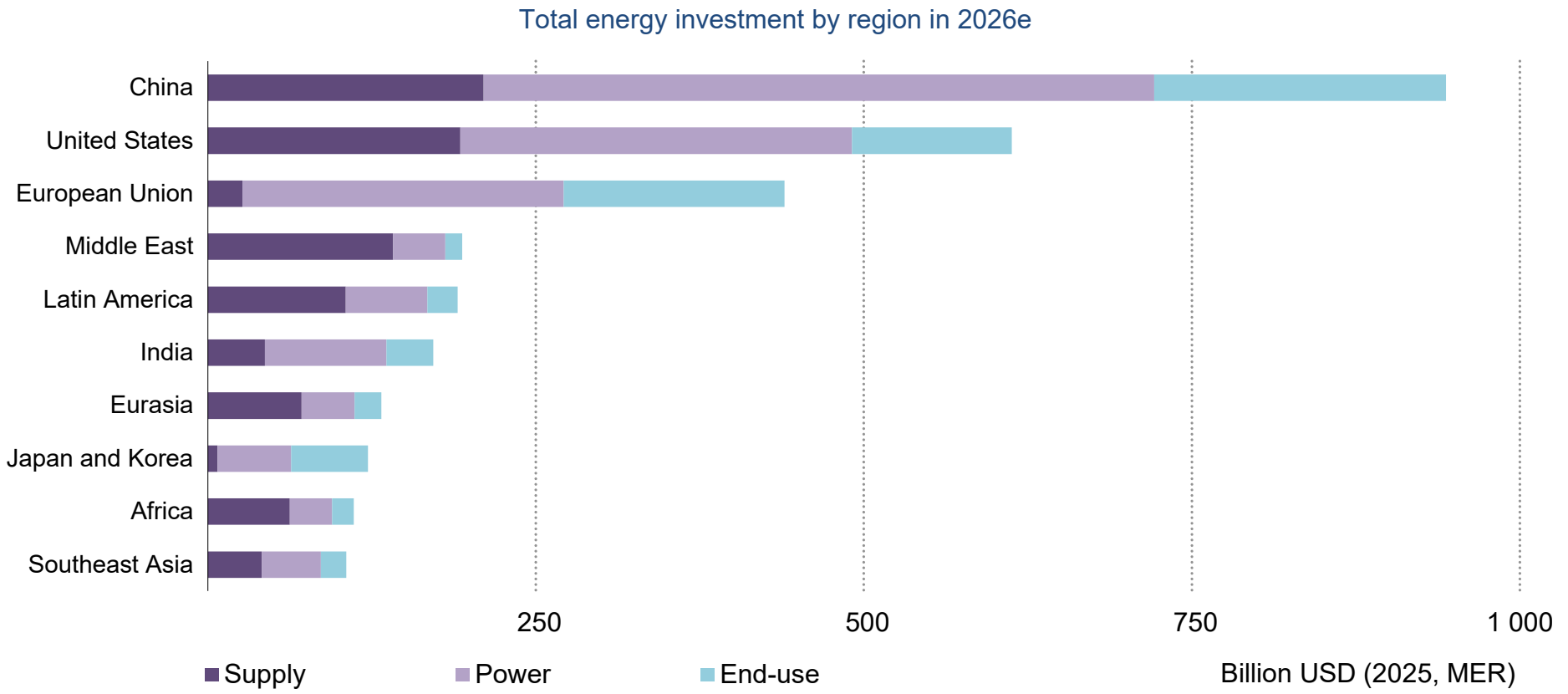
Global investment in energy, 2016-2026e (left) and change in investment between 2016 and 2026e (right)



Around USD 2.2 trillion is expected to be spent on renewables, nuclear, grids, storage, low-emissions fuels, efficiency and electrification, nearly twice as much as is going to oil, natural gas and coal.

Notes: MER = market exchange rate. 2026e = estimated. Oil, natural gas and coal includes both supply and generation investment.

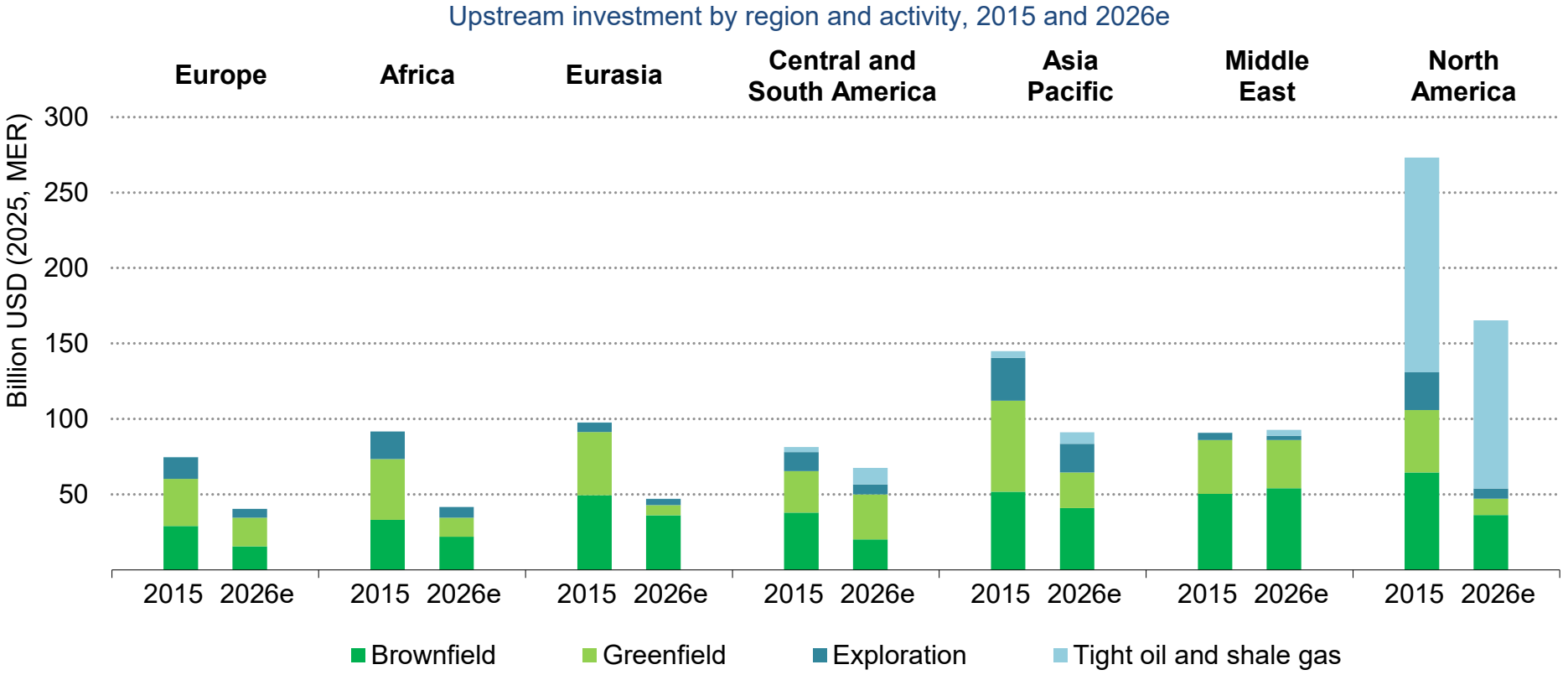
Advanced economies and China make up over 70% of total energy investments in 2026, with nearly half of all global spending going to the power sector



Emerging market and developing economies other than China account for less than 30% of total energy investment and 20% of power sector investment, despite having two-thirds of the world's population.

Note: MER = market exchange rate.

Overall upstream investment has been lower in the post-COVID period with the share of exploration spending declining across all regions



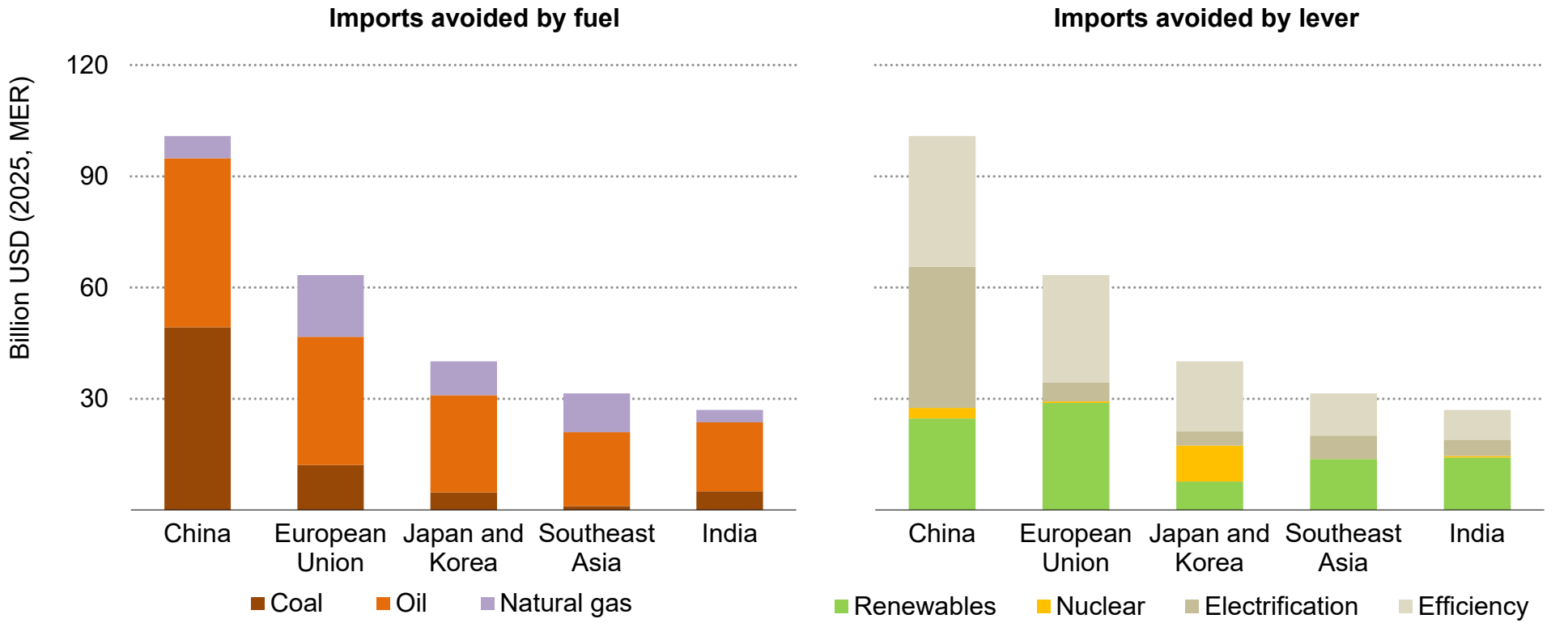
A shift towards shorter cycle projects, structurally lower costs, and stronger capital discipline underpinned an a 55% decline in global upstream oil and gas spending between 2015 and 2026.

Note: MER = market exchange rate.

Source: IEA analysis based on Rystad (2026), Rystad Energy Cube Browser.

Electrification and clean-energy investment decisions of the past reveal the fuel-saving effects on energy security

Avoided fossil fuel imports in 2025 in net energy importing regions, resulting from clean-energy investments of 2015-2024

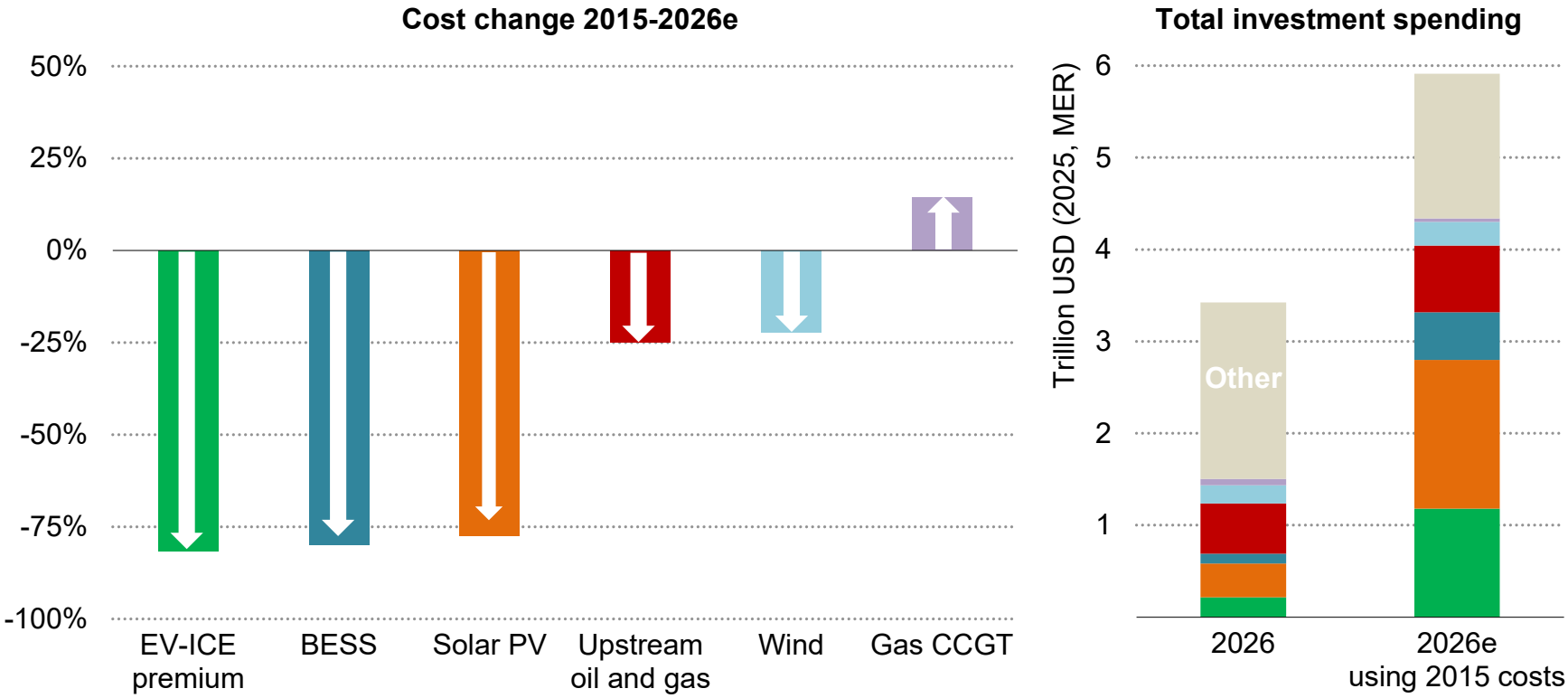


Over USD 260 billion in fossil fuel import costs were avoided in 2025 thanks to cumulative investments in efficiency and alternative sources of energy in key net energy-importing regions since 2015.

Notes: MER = market exchange rate. Prices used in this analysis are based on IEA (2025), World Energy Outlook 2025. Given that Southeast Asia is a net exporter of coal and natural gas, the value indicates the incremental revenue from these exports.

Without innovation and scale-up driving cost reductions, the energy investments anticipated for 2026 would be nearly twice as expensive to deliver the same additions

Changes for selected costs, 2015-2026 (left) and total investment spending in 2026e, with and without cost reductions (right)

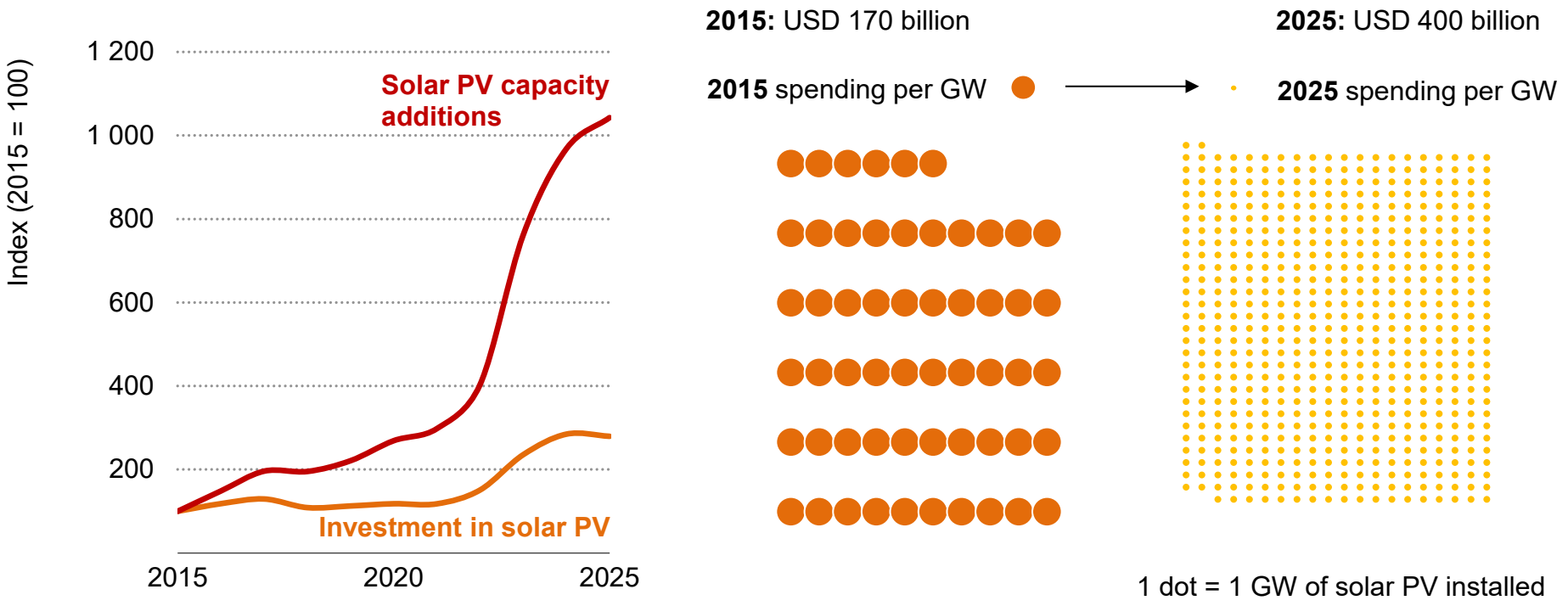


Innovation has reduced EV, BESS and solar PV costs by around 80% over the past decade. Without cost reductions, achieving the same levels of additions in 2026 for these two technologies would have required around USD 3.3 trillion.

Notes: MER = market exchange rate. EV = electric vehicle. ICE = internal combustion engine. BESS = battery energy storage system. CCGT = combined-cycle gas turbine. Battery storage costs refer to utility-scale, four-hour systems. Upstream oil and gas costs refer to finding and development costs.

A 80% decline in capital expenditure required to add 1 GW of solar PV into the system in the last decade has supported a near ten-fold increase in annual capacity additions

Investment in solar PV and capacity additions, 2015-2025

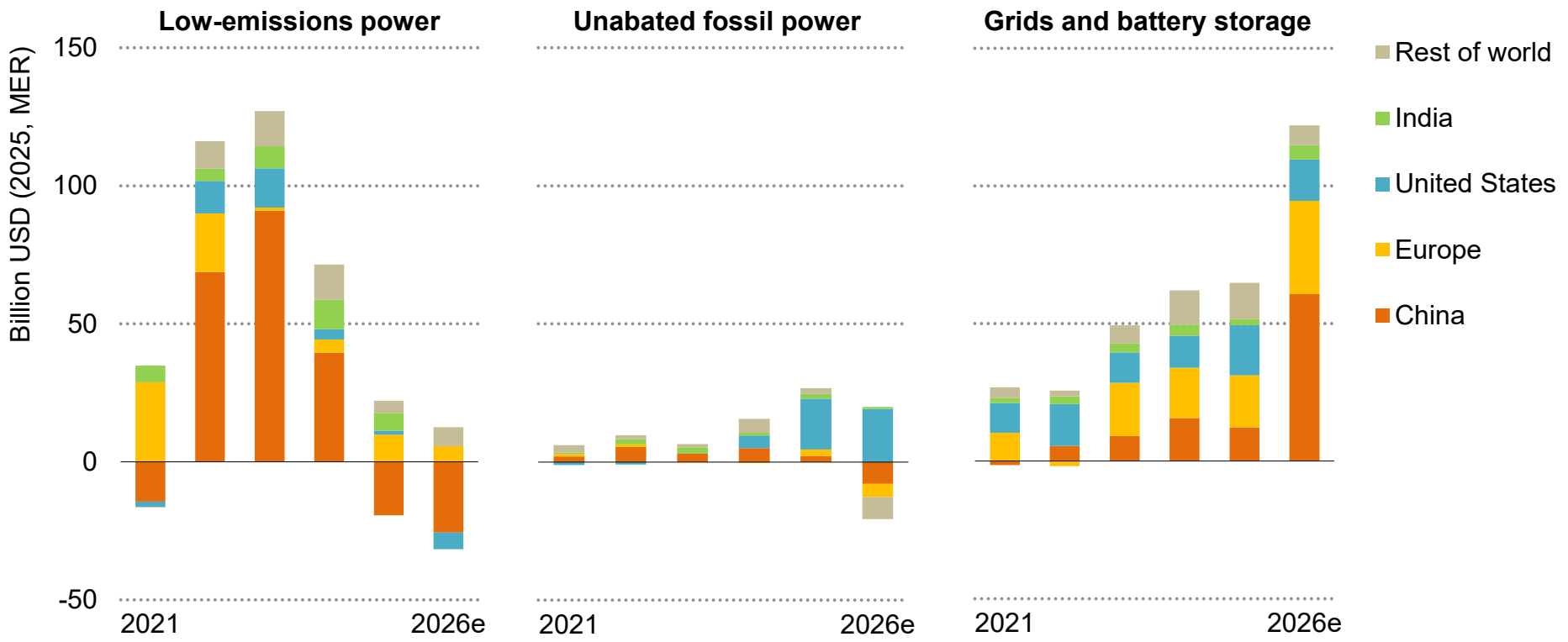


In 2015, adding 1 GW of solar PV capacity required around USD 3 billion in investment. In the last decade, rapidly declining module costs and supportive government policies have reduced average investment requirements to USD 0.7 billion per GW.

Note: Chart shows US dollars with 2025 market exchange rates.

Additional spending on grids and storage drive growth in power sector investments

Annual year-on-year investment growth for the power sector by category, 2021-2026e

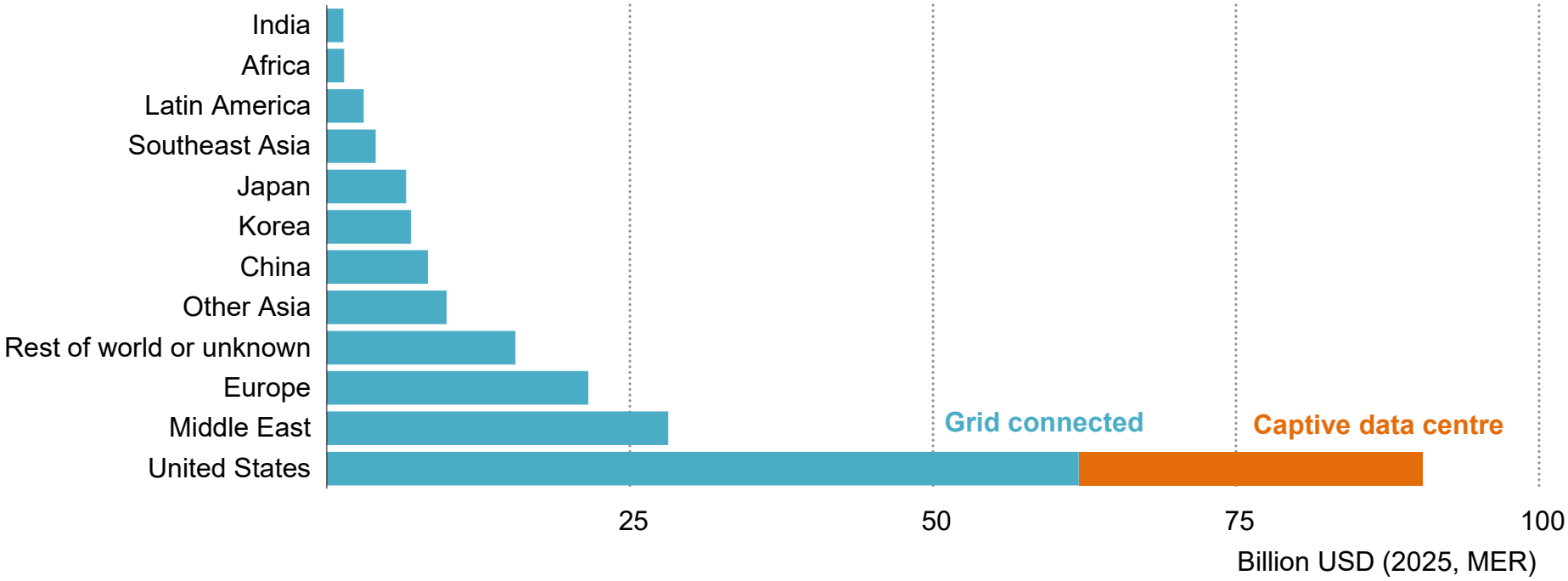


Renewables investment has slowed in response to declining costs and notable policy shifts in the United States and China, despite strong growth in other emerging market and developing economies.

Note: MER = market exchange rate. “Low-emissions power” refers to renewables, nuclear, renewable waste, fossil power with CCUS, and generation from low-emissions ammonia or hydrogen.

Securing electricity supply for artificial intelligence is driving investments for new gas generation to a 25 year high

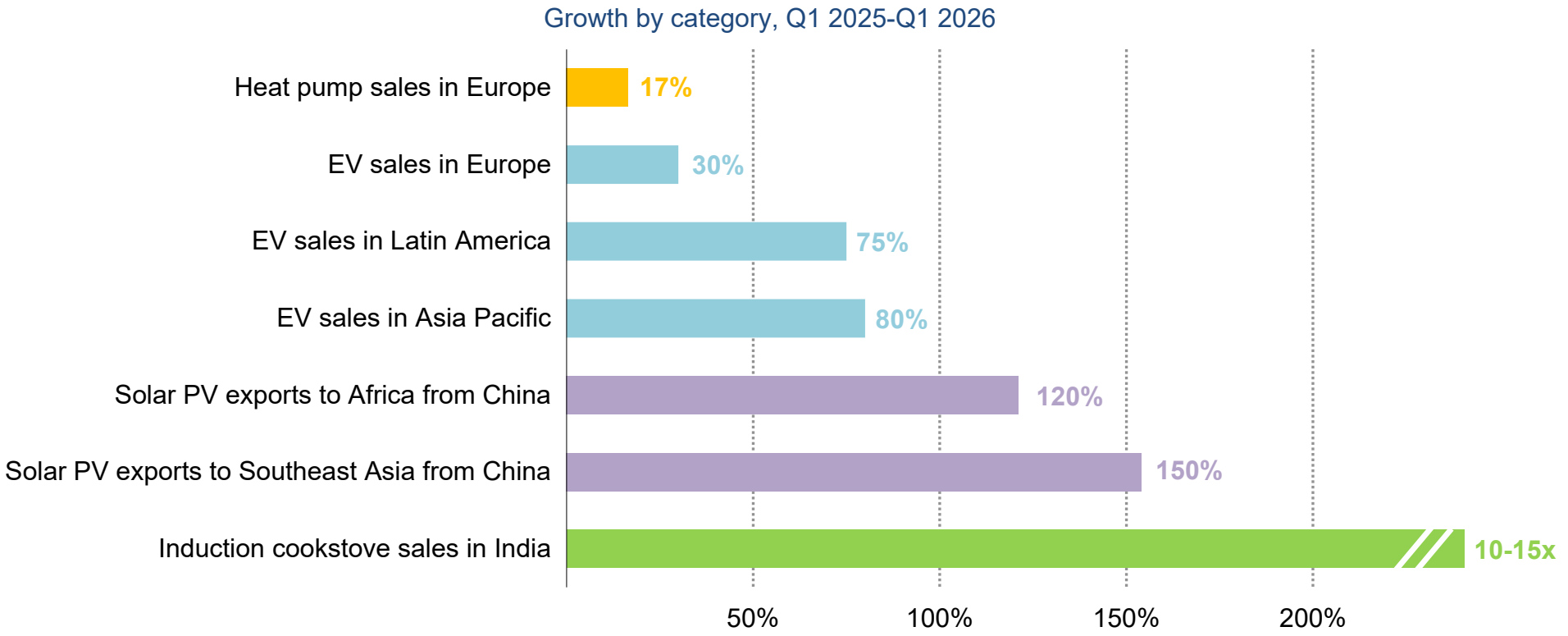
Value of new gas generation FIDs by country or region and use-case, Q1 2025–Q1 2026



Since Q1 2025, the value of new gas-turbine orders intended to supply captive power for US-based data centres is greater than total orders in any other country.

Notes: MER = market exchange rate. FID = final investment decision. Values indicate the total project investment in the year or quarter the turbines are ordered.
Source: IEA analysis based on McCoy (2026), Gas Turbine and Steam Turbine Order data.

There are early signs consumers are turning to electrification in response to supply disruptions



There has been strong growth in Q1 2026 spending on key categories including heat pumps, EV sales and solar PV in some regions. In India, LPG supply disruptions led to a surge in induction cookstove sales.

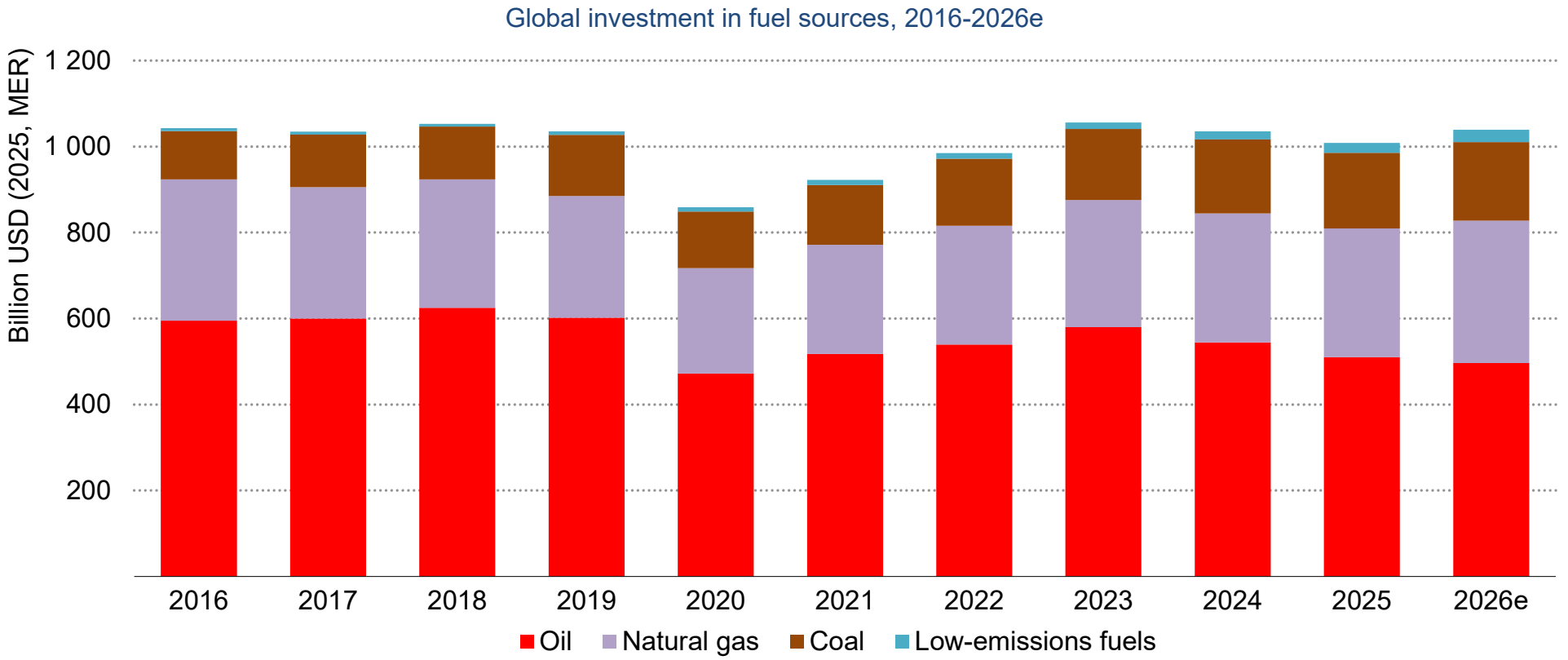
Note: Heat pump sales include Q1 sales of Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Poland, Sweden and Switzerland.

Source: IEA analysis based on General Administration of Customs of the People's Republic of China (2026); European Heat Pump Association (2026); and IEA (2026), Global EV Outlook 2026.

Supply

Overview

Despite the Middle East conflict, capital outlays on fuels are expected to rise about 3% in 2026, driven mainly by investment in natural gas projects



Announced investment plans suggest a third consecutive year of lower oil supply spending in 2026. Still, overall fuel investment is set to rise marginally as expenditures in natural gas increase to USD 330 billion and in coal supply increase to the highest level since 2012.

Notes: MER = market exchange rate. 2026e = estimated. capex = capital expenditure. Oil, natural gas and coal include upstream, refining and infrastructure investment. “Low-emissions fuels” comprises modern bioenergy, low-emissions hydrogen, hydrogen-based fuels and carbon capture, utilisation and storage (CCUS).

Fuel investments have stabilised at around USD 1 trillion per year since 2023, but the conflict in the Middle East raises major questions about the future

Considering company investment plans through the first quarter of 2026, the competing pressures of momentum of projects already under construction, higher prices, higher costs, repair needs and losses to supply and disruptions to operations, we estimate that investment in fossil fuel supply in 2026 is set to total just over USD 1 trillion. This will return total investment to the 2024 level – a recovery from the near-3% drop that occurred from 2024 to 2025.

Company guidance for 2026 capital spending has remained largely unchanged despite the Middle East conflict. There is typically a great deal of inertia in investment spending from year-to-year, reflecting continued spending on previously approved projects and long-term strategies. Still, the conflict could leave a lasting mark on investment trends as strategies shift in response to changes in price expectations as well as in risk perceptions attached to different fuels and locations. In this chapter we discuss some ways these shifts could play out, but our assessment is naturally very provisional given the huge uncertainties regarding the conflict.

Investment responses will depend in part on perceptions about the duration of the conflict and the durability of higher prices. Few companies, even in price-responsive segments of the market such as US shale, react to temporary price shocks. But this does not hold if the conflict is drawn out and begins to reset longer-term expectations.

The first to move are typically the smaller independents, while larger players – including national oil companies (NOCs) and the majors – tend to hold more to established guidance. A decade of declining exploration activity, thin inventories of derisked prospects and tight offshore rig markets could also constrain investment.

Furthermore, we need to consider geographical variations in responses. For some Middle Eastern NOCs, revenues are markedly lower and their host governments have already been strongly affected, potentially constraining funds available for capital investment. For others – most notably Saudi Aramco and Abu Dhabi National Oil Company (ADNOC) – the use of infrastructure that can bypass the Strait of Hormuz and higher prices mean revenues have been much less impacted. Further, even though construction and development activity in many countries has been impacted, ongoing operational support means investment continues, which – alongside supply chain inflation – will translate into cost overruns and an increase in 2027 investment rather than a large reduction in 2026 spending. Many countries in the region will need to redirect investment towards restarts and repairs, with many damaged energy assets being assessed, including upstream facilities, refineries, petrochemical plants, and 2 of the 14 trains at the huge Ras Laffan liquefaction site in Qatar. Countries are also examining how to expand and build new bypass infrastructure. On balance, we estimate that upstream oil and gas investment in the Middle East will fall by around 1% in 2026.

Among fuel importing countries, shifting risk perceptions may also lead to a focus on domestic resource development over reliance on imports, or a complete shift away from fuel reliance by pushing harder for alternatives. Efforts to secure alternative supply sources could also prompt increased fuel investment by exporters outside the Middle

East. In Central and South America and Africa, upstream oil and gas investment is expected to increase by over 10% in 2026, as on-going projects gain momentum.

Our expectations for investment in 2026 show some strong variations across the different fuels. Oil supply is set for another subdued year, with spending falling by around 3% as companies remain focused on capital discipline and extracting the most from existing assets through operational efficiencies such as longer lateral drilling in both unconventional and conventional settings.

In contrast, spending on natural gas supply is poised for growth of more than 10%, given the prospect of growing demand – notably in the United States – and for new liquefied natural gas (LNG) export facilities. The market-easing effects of the major wave of new LNG supply, which were expected to be felt this year, have been delayed. This has kept markets tight and caused further reputational damage for natural gas, especially among the price-sensitive emerging market and developing economies in Asia that the gas industry is relying on as future consumers of imported LNG.

Coal investment has been increasing steadily over the past six years, and the current crisis is likely to reinforce it, with the anticipated investment of USD 180 billion in 2026 the highest since 2012. Over USD 100 billion of this is for steam coal production in People's Republic of China (hereafter, "China")., which is a 7% increase from 2025 – and nearly double the investment of a decade ago. Outside of China, steam and coking coal investment in aggregate is set to fall for the second consecutive year since 2024.

Investment in critical minerals fell in 2025, with capital spending by major mining companies decreasing roughly 9% following several years of rapid growth. This downturn primarily reflects an investment drop of over 20% for battery metals, including a sharp 40% contraction for lithium, reflecting weaker prices and heightened market uncertainties. By contrast, copper investment increased 8%, underscoring its central role in electrification.

Exploration spending for critical minerals also weakened, with activity falling in Australia (-30%) and the United States (-20%). Beyond cyclical pressures, financing constraints continue to hinder supply diversification. Along with price volatility and uncertainty over long-term offtake, capital costs for mining and refining projects are higher for emerging regions than for incumbents.

Investment in liquid biofuels and biogases is set to rise around 5% in 2026 (to over USD 16 billion) and could also benefit from a premium for domestic resource development. However, sensitivities about possible trade-offs with food security are also likely to be heightened by the conflict, which has tightened markets for fertilisers as well as fuels.

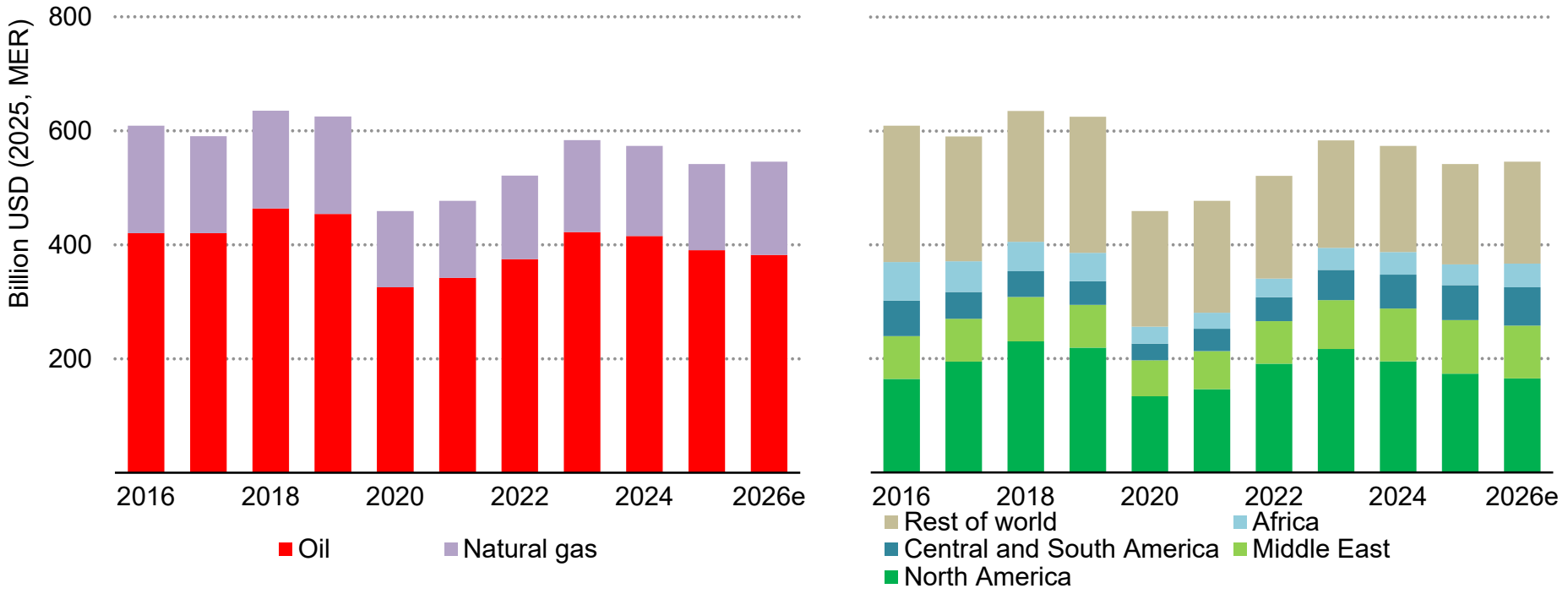
Low-emissions hydrogen investment is expected to hit a new high in 2026, rising 50% to nearly USD 10 billion, with 70% allocated to electrolysis projects and 30% to fossil fuel use with carbon capture, utilisation and storage (CCUS). Europe, the United States and China led investment in 2025 and projects remain highly policy-contingent, and delays and cost inflation remain widespread.

Global CCUS investment reached above USD 5 billion in 2025, 17 times more than in 2020, led by Europe (around 45%). However, only a small portion of announced projects are moving forward; around 90% of them have yet to achieve financial close.

Oil, natural gas and coal

Global upstream investment rises marginally in 2026, with declines in North America and the Middle East offset by increases in Africa and Central and South America

Oil and gas upstream investment (left) and by region (right), 2016-2026e



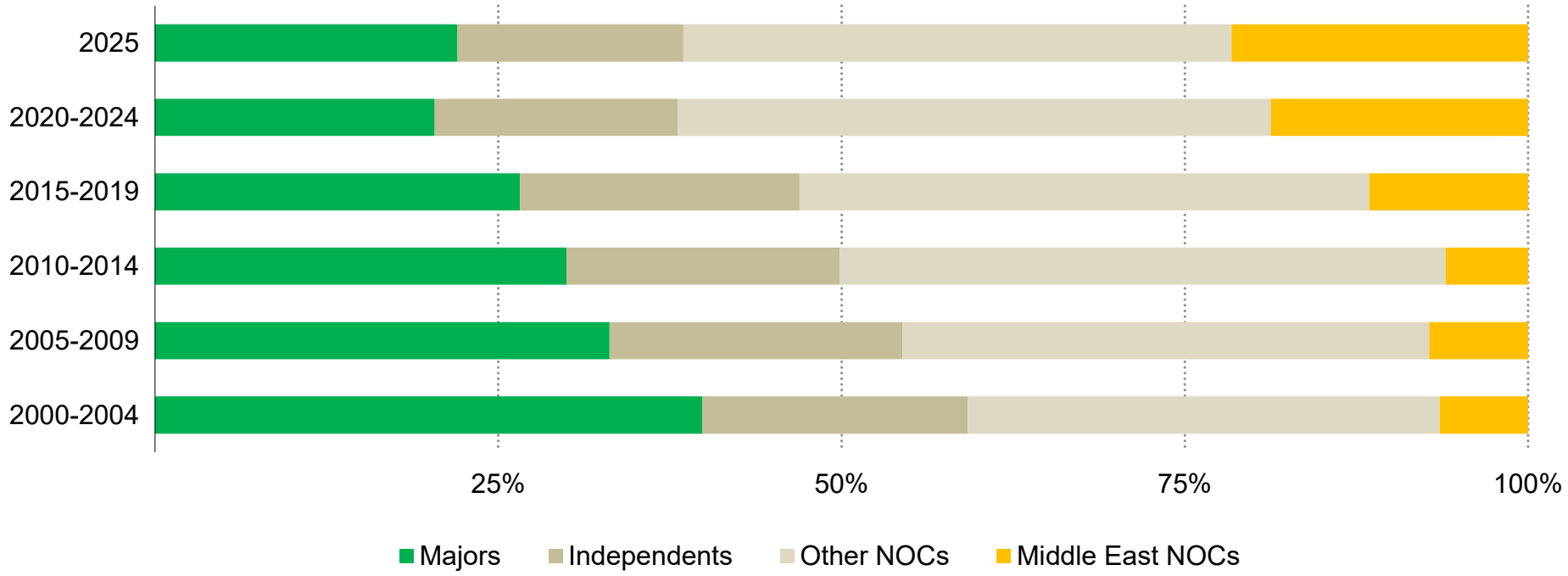
North American investment falls in 2026 due to capital discipline and technological gains, while the conflict weighs on investment in the Middle East; these drops are offset mainly by increases in Central and South America and Africa as recent discoveries are developed.

Notes: MER = market exchange rate. 2026e = estimated. For regional definitions, see the Methodology Annex.

Sources: IEA analysis based on Bloomberg (2026), Bloomberg Terminal; FRED (2026), Producer Price Indexes; IEA (2025), WEO Database (accessed 20 May 2026); IMF (2026), World Economic Outlook database (accessed 20 May 2026); Rystad (2026), Rystad Energy Cube Browser; and company reporting.

National oil companies have been increasing their share of upstream spending through strategic expansion and state-backed projects

Average share of upstream spending by company type and period, 2000-2025



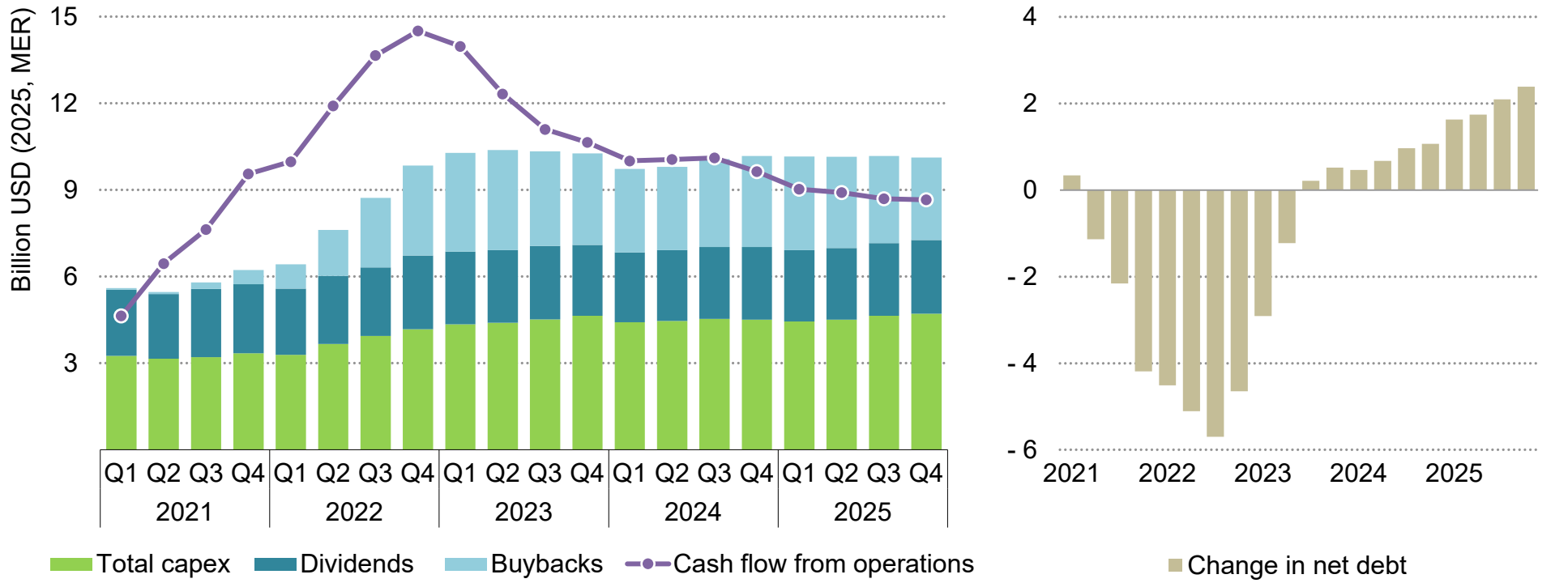
Collectively, all NOCs have contributed a rising proportion of capital investment over the last 20 years, reflecting the proportional increase in spending by NOCs, and decrease by majors and independents.

Notes: NOC = national oil company. “Majors” are BP, Chevron, ConocoPhillips, ENI, ExxonMobil, Shell and TotalEnergies. This sample of companies is responsible for about 75% of global production.

Sources: IEA analysis based on Bloomberg (2026), Bloomberg Terminal; Rystad (2026), Rystad Energy Cube Browser; and company reporting.

Amid declining cash flow post-2022, net debt increased for majors and dividends held steady

Majors' average selected cash uses and cash flow from operations (left) and change in net debt (right), 2021-2025



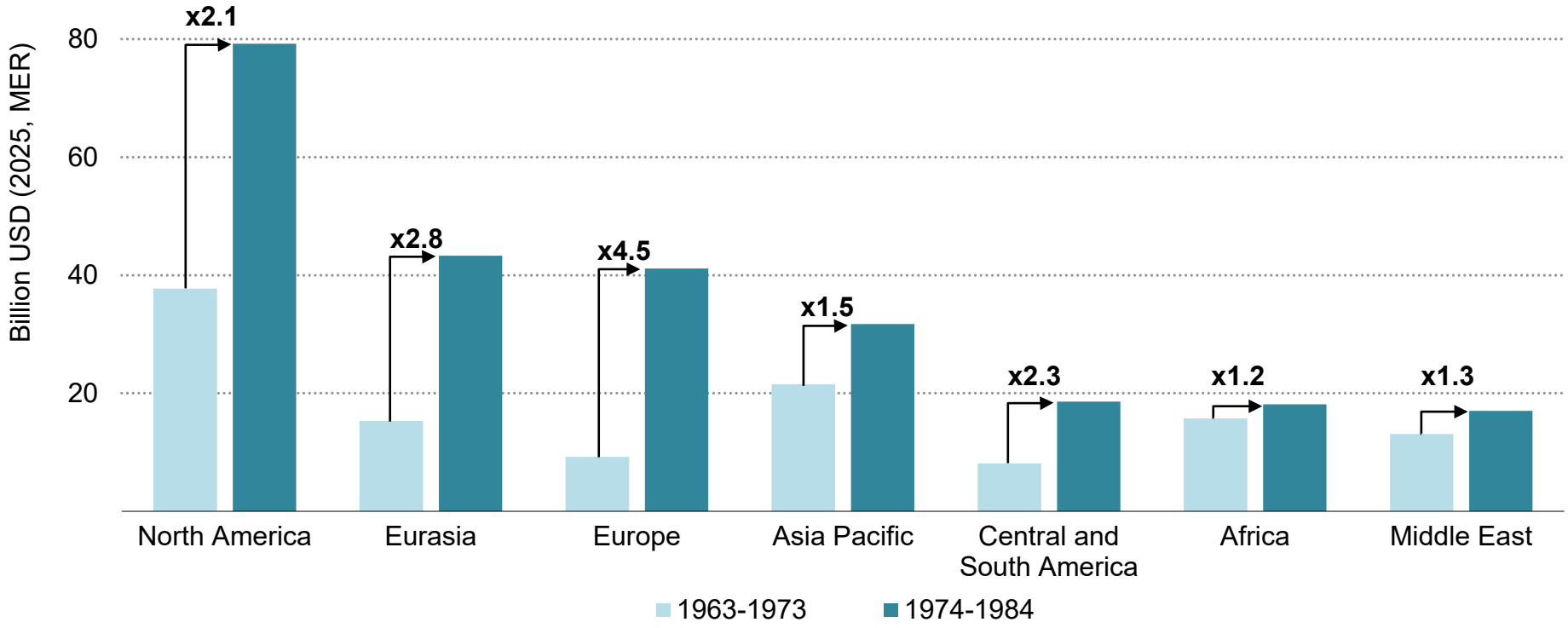
Following deleveraging in 2021-2022 supported by elevated oil and gas prices, net debt grew 45% as capex and shareholder payouts began exceeding CFFO. The rise in net debt occurred through both cash reserve drawdowns and new debt issuance.

Notes: MER = market exchange rate. Capex = capital expenditures. CFFO = cash flow from operations. Values reflect rolling four-quarter, production-weighted averages. Majors are: BP, ConocoPhillips, Chevron, Eni, ExxonMobil, Shell, TotalEnergies.

Source: IEA analysis based on Bloomberg (2026), Bloomberg Terminal.

Previous oil crises spurred investment in upstream oil and gas in importing regions

Annual average investment in upstream oil and gas ten years before and after the 1973 oil crisis, 1963-1984



In the last 65 years of oil and gas activity, geographical shifts in investment have been tied to geopolitical events such as development of the North Sea in the decades following the oil embargo, but this also depleted the resource base in these new provinces.

Notes: MER = market exchange rate. For regional definitions, see the Methodology Annex.
Source: IEA analysis based on Rystad (2026), Rystad Energy Cube Browser.

Despite the huge market disruption from the Middle East conflict, overall upstream oil and gas investment is expected to rise marginally in 2026 to USD 546 billion

The Middle East conflict has led to considerable increases in oil and gas prices, impacted supply routes, damaged fields and infrastructure, and could materially change the demand outlook. It may have significant implications for future investment strategies, but – building on company reporting since the start of the conflict – we estimate that global upstream oil and gas investment in 2026 will be USD 546 billion, similar to 2025 levels. This includes a 8% increase in natural gas investment offset by a slight decline in oil investment.

Our estimate for upstream investment in 2026 is only marginally lower than the level expected prior to the conflict, but reflects the inertia in investment spending, given spending on previously approved projects, announced strategies to maintain capital discipline, and depleted exploration pipelines.

In the Middle East, investment in 2026 is affected by counterbalancing pressures and on balance our view is that investment will drop by around 1% from 2025 levels. Higher commodity prices, supply chain inflation, repair needs, and opportunities to continue contracted work – and invoke contract premiums – are boosting investment. Meanwhile physical damage, production shut-ins, lower revenues for several producers, and demobilisation over safety concerns are reducing the ability of companies to deploy capital. There are signs of reduced spending from service company financial results, which show year-on-year decreases in the region.

Countries with no export routes other than the Strait of Hormuz are receiving lower revenues because of reduced production – returns that would normally be used to fund capex commitments. Kuwait Petroleum Corporation (KPC) is producing oil for domestic consumption while in Bahrain, Bapco's force majeure declaration covers group operations in their entirety. Iraq has announced several programme suspensions, but it has also committed investment from joint ventures and a USD 5 billion pipeline investment. In Qatar, North Field expansions are set to be delayed, but this does not necessarily translate into lower investment, as the projects involve binding engineering, procurement and construction (EPC) contracts, committed equity from partners, and long-term sales and purchase agreements.

Oil producers with large sovereign wealth funds and capacity that can bypass the Strait of Hormuz (principally the United Arab Emirates and Saudi Arabia) are looking to retain or even accelerate their investment programmes. The United Arab Emirates left OPEC on 1 May 2026, and the Abu Dhabi National Oil Company (ADNOC) has committed to award USD 55 billion in contracts over three years as the first tranche of a USD 150 billion five-year capex plan. Part of this

investment is likely to be directed towards infrastructure that can bypass the Strait of Hormuz. Prior to the conflict, Saudi Aramco had indicated total 2026 capital investment of USD 50-55 billion, to continue development of the Jafurah unconventional gas field, as well as the Marjan, Berri and Zuluf offshore fields. It has since indicated that it will maintain its original capex guidance, with conflict reinforcing its long-term investment in reserves and infrastructure.

Outside the Middle East, many companies are constrained by long project cycles, tight offshore rig markets, and a depleted pipeline of undeveloped discoveries after years of weak exploration.

Global conventional exploration spending peaked at around USD 160 billion in 2013 and has since fallen to roughly USD 50 billion per year. So far, average annual conventional discoveries have declined from more than 30 billion boe in the 2000s to less than 10 billion boe in the 2020s. A thin inventory of derisked greenfield projects is concentrated in a few countries (Namibia, Guyana, Brazil and Suriname). Several new upstream exploration projects are emerging along the west and east coasts of Africa, throughout Southeast Asia, in Alaska, and in the US Federal Offshore region as exploration investment seeks to broaden the global pipeline of projects that can be converted into new final investment decisions (FIDs) while meeting cost and risk thresholds.

Offshore rig market equipment and crew constraints are also preventing rapid exploration investment scale-up. Westwood and other rig trackers show that globally marketed jack-up rigs, drillships and semi-submersible supplies have been shrinking due to retirements and idle hold depreciation. In 2025, around 64 units had been effectively idled for more than five years and are unavailable without major reactivation work. Committed utilisation is already expected to be greater than 90% for marketed rigs in 2026.

The impact of the conflict on longer-term investment strategies is less clear and will depend crucially on how long it lasts and how quickly trade flows can recover. Previous major oil crises have catalysed major waves of upstream oil and gas investment in importing regions. In the ten-year period after the 1973-1974 oil crisis, North America, Eurasia and Europe increased investment by two to almost five times, opening up production in Alaska, the US Federal Offshore region, the West Siberia and Caspian regions, and the North Sea. Most of these regions are now much more mature, but higher prices could encourage companies to spend more on exploration and to develop projects that were previously considered less commercially viable.

Governments may also introduce measures to encourage more domestic production, which – given the higher-cost nature of these barrels – could lead to a material increase in investment in subsequent years. However, these same governments could also prioritise investments that switch energy service demand away from oil and gas (e.g. through greater electrification of mobility). Higher prices may also supress demand and further cloud the longer-term rationale for investment increases.

Investment by majors has fluctuated substantially in the past two decades. It rose to more than USD 200 billion in 2013-2014 as high oil prices made higher-cost projects economical but has since

dropped by more than 50%. In the meantime, the group's total production grew 50%, implying significant gains in capital efficiency and freeing up capital for shareholder compensation through dividends and buybacks. After reducing debt in 2021 and 2022, payments to shareholders rose at a faster pace than cash flow. In the first quarter of 2026, majors indicated that higher earnings would continue to be directed primarily towards dividends and buybacks growth, as well as deleveraging, pending an easing of working capital pressures due to temporary timing effects (BP was the main exception, having suspended buybacks in February). Investment plans are not reacting as quickly: of all the majors, only ConocoPhillips announced a 2% increase to its previous 2026 midpoint guidance to boost unconventional drilling activity in the Permian.

For North America, we estimate that investment will total around USD 165 billion in 2026, a 5% reduction from 2025. In offshore areas, investment is concentrated among several projects (e.g. Tiber, Kaskida, Whale and Ballymore) at different stages of development. On land, several companies continue to expand their existing assets: ConocoPhillips, for example, is directing its focus to the Willow project in Alaska. In Canada, capital spending by the four largest oilsands producers (CNRL, Cenovus, Suncor and Imperial) is projected to reach about USD 14 billion in 2026, a 5% increase from 2025. Tight oil and shale gas investment will fall by around 7% in 2026 (to USD 72 billion) on a regional basis.

Independents are likely to be able to respond most rapidly to higher oil prices and geographical security. The US tight oil industry has historically been the most price-responsive owing to its short development cycles and cost structure. Yet, only a handful of operators have increased their investment guidance to add drilling rigs and completion crews, and most indicate that they will maintain capital discipline and rely on capital-light measures to boost production, such as drawing down their inventory of drilled but uncompleted wells, increasing workovers and reallocating capital from gas to liquids-weighted assets.

In Europe, around USD 40 billion has been committed in 2026, broadly in line with 2025. Exploration programmes for the North Sea, the Mediterranean Sea and the Black Sea have been renewed in recent years. In Norway, 76 blocks have been offered for exploration in the Barents and Norwegian Seas, and 57 new production licences have been issued for the Norwegian continental shelf. Meanwhile, the UK North Sea Future Plan will stop issuing new exploration licences but will continue to offer production support for extraction near existing infrastructure.

In sub-Saharan Africa, investment is set to rise 12% to nearly USD 24 billion in 2026, following an 18% year-on-year decline in 2025. BP's investment in 2026 is centred on increasing production in Angola and Namibia's Orange Basin through the Azule Energy joint venture. LNG supply development continues in both Nigeria and Mozambique by a variety of majors and local companies. Nigeria is also developing deepwater prospects in partnership with majors.

In Eurasia, around USD 47 billion is set to be invested in 2026, broadly flat year-on-year after several years of decline since 2018. Upstream investment plans in Russian Federation (hereafter, “Russia”) have been constrained by the priority to support the war economy, but the boost to revenues in 2026 could filter through into capex plans.

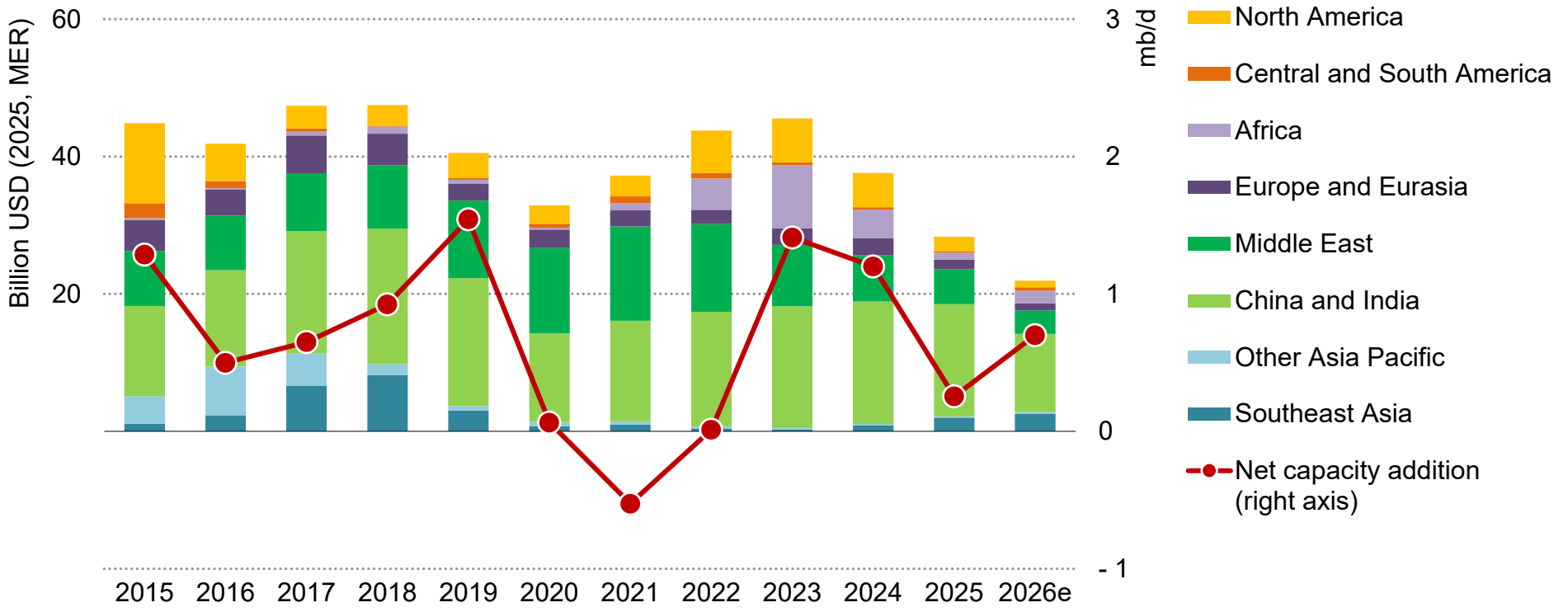
In South and Southeast Asia, investments are set to increase 10% in 2026 to USD 23 billion as NOCs and public-company partnerships continue to develop. The unproven Andaman-Nicobar Basin, which straddles four countries, is emerging as an opportunity for both NOCs and majors to develop a new area, while ENI’s nearby 5-tcf discovery in the Kutei basin contributes to the region’s reserves. Investment from India’s ONGC includes a USD 20 billion deepwater drilling plan as part of India’s goal to attract USD 100 billion in investment. Both TotalEnergies and ENI have signed gas-focused exploration and production agreements with PETRONAS to broaden their collaboration in this region.

In Central and South America, investment is set to increase nearly 10% to USD 68 billion in 2026. In Brazil, 19 of the 34 exploration blocks awarded in the 5th Cycle of the Open Acreage of Concession were secured, with exploration investment commitments of USD 300 million. Exploration activity is also gaining pace in offshore Uruguay, with ongoing seismic campaigns and one exploration well planned by APA. In Guyana, ExxonMobil’s floating production, storage and offloading (FPSO) developments in the Stabroek block are targeting around 1.5 mb/d of total capacity across seven sanctioned projects by 2030, including the USD 7 billion Hammerhead project (150 kb/d) due online in 2029.

In Suriname, TotalEnergies and APA have taken FID on the country’s first major deepwater project in Block 58, a USD 10.5 billion development expected to produce about 220 kb/d from 2028. Meanwhile, the Vaca Muerta development expansion continues as Argentina LNG develops partnerships. In Venezuela, production is expected to begin recovering in the next couple of months, but restoring it to around 3 mb/d would require several hundred billion US dollars in cumulative investment over the next decade for greenfield developments and rehabilitation of critical infrastructure.

Net refinery capacity is set to grow in 2026, reflecting a slowdown in closures, but new refinery investment is expected to fall to decade-level lows

Investment in oil refineries (greenfield and upgrades) by region and net refining capacity additions, 2015-2026e



Investment in new refineries is expected to fall to just over USD 20 billion, down 25% from 2025, with nearly all new capacity in emerging markets and developing economies. All refinery investment in advanced economies is for maintenance and upgrades.

Notes: MER = market exchange rate. 2026e = estimated. Estimates are based on the announced project pipeline. For regional definitions, see the Methodology Annex.

Investment in oil refining falls further as structural declines meet intensifying geopolitical disruption

Investments in the refining sector in 2026 are set to drop to just over USD 40 billion, about a 15% decrease from 2025. About half of spending is for upgrades and greenfield projects, and the other half is for maintenance at existing facilities. In 2025, net capacity increased by 0.3 mb/d after total closures of more than 1 mb/d. With many fewer closures slated in 2026, an increase of 0.7 mb/d is expected. It remains to be seen whether the Middle East conflict will change refinery investment strategies, as governments could become warier of high reliance on oil product imports. The disruption could also prompt increased spending to build up commercial and strategic stocks.

Based on our pre-conflict expectations for investment, a high share of spending in India is allocated to greenfield developments to support 265 kb/d of capacity additions. Investment in China continues to drop as a wave of new refinery and petrochemical complexes comes online (adding over 300 kb/d of capacity), and “teapot” refineries slated for closure may remain open for longer to help the country weather supply disruptions.

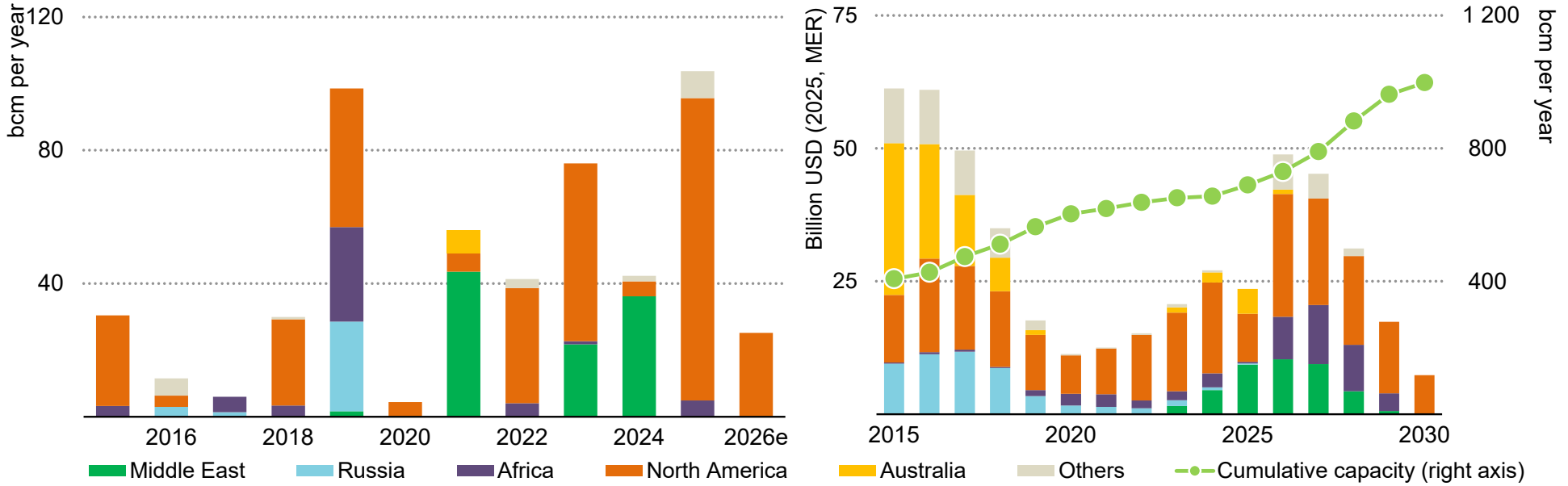
The Middle East conflict has affected refinery operations within and outside the region. Refinery economics have been impacted to varying degrees, and there have been a range of product price increases and force majeure declarations. The conflict in Ukraine is also continuing to impact refineries in Russia as Ukraine targets operations.

Bapco (in Bahrain) declared force majeure and was forced to prioritise domestic supply and halt export obligations when its nearly 400 kb/d capacity was damaged in drone strikes. At the same time, the Petrochemical Corporation of Singapore (PCS) and Aster Chemicals cited severe supply chain failures and upstream naphtha/crude feedstock shortages stemming from the conflict. In India, the Mangalore Refinery and Petrochemicals company (MRPL) declared force majeure because of upstream crude supply disruptions.

Elsewhere, in the United Kingdom, Phillips 66 announced plans in January 2026 to acquire the assets of Prax Lindsey Oil Refinery Limited, integrating storage, terminal and pipeline infrastructure into its nearby Humber Refinery. The total investment amount has not yet been announced, but its 2026 refinery capital expenditure is set at USD 1.1 billion. In Austria, the newly created Borouge Group International formed by OMV and ADNOC (estimated to be worth USD 60 billion) will inherit a global production footprint of close to 14 Mt of polyolefin capacity spread across Europe, the Middle East and North America. This merger will concentrate global supplies under one enterprise.

Spending on LNG is booming, with new export projects under construction adding 300 bcm per year by 2030

Final investment decisions for LNG export capacity, 2015-2026 (left) and investment and cumulative export capacity, 2015-2030 (right)



Despite the drop in investment in the Middle East as under-construction projects remain on hold, LNG investment globally is expected to more than double in 2026 from 2025 as over 230 bcm of projects outside the Persian Gulf advance towards peak construction.

Notes: bcm = billion cubic metres. MER = market exchange rate. LNG = liquefied natural gas. 2026e = estimated 2026 FIDs based on data to May 2026. The outlook for cumulative export capacity includes Qatar's delayed new project startups.

Record LNG approvals are reshaping the gas outlook even as the Middle East conflict is curtailing supply prospects for price-sensitive importers

2025 was a record year for LNG project FIDs, with decisions announced for over 100 bcm of capacity, requiring a total capital expenditure of around USD 80 billion over the next several years. Nearly 90% of sanctioned projects are in the United States.

Prior to the crisis in the Middle East, around 45 bcm of new LNG supply had been expected to come to market over the course of 2026. Qatar was due to commission the already-delayed first train of its North Field East expansion (11 bcm/yr) in the third quarter of 2026, but according to statements from Qatar Energy, this will likely be delayed for more than a year. Thus, total incremental LNG supply in 2026 is now closer to 40 bcm.

The three remaining trains in Qatar's North Field East expansion, totalling some 32 bcm of annual capacity, were expected to come online in 2027 and 2028, and a further 20 bcm from the North Field South project was due online by 2028. The 20-bcm North Field West project is at an earlier stage of development with startup targeted for the early 2030s. The United Arab Emirates is also in the process of developing its new 13 bcm/yr Ruwais project. Total anticipated capital spending for these projects is estimated at USD 50 billion, but there had been no formal announcements on the status of these projects at the time of writing. A further 230 bcm of LNG capacity outside of the Persian Gulf is currently under construction.

Nearly USD 50 billion of spending on export terminals is expected globally in 2026 – more than doubling from 2025 – despite the deferment of some capex in the Middle East as project timelines slip while operators seek to retain their workforces. Outside of the Middle East, spending is ramping up for new projects approved in 2025, and for around 100 bcm/yr of projects approved before 2025 that are slated to come online over the next two years. Capital spending on export terminals typically peaks around two to three years after FID.

Two projects have reached FID in 2026 so far: Venture Global's USD 8.6 billion second phase of CP2, announced in March, and Caturus' USD 13 billion Commonwealth LNG, announced in May. In addition, TotalEnergies also announced the full restart of its USD 20 billion Mozambique LNG project in early 2026. There remains a pipeline of over 700 bcm of projects globally seeking FIDs, including around 110 bcm in the United States that have received regulatory approval.

Prior to the Middle East conflict, LNG developers were becoming concerned that supply chain costs were rising, adding upward pressure to project budgets. Indeed, we estimate that around 30% of projects currently under construction – totalling roughly 85 bcm per year – have had cost overruns. While the range is considerable, industry-wide average additional spending is around 20%, adding around USD 15 billion to total capital expenditure for LNG

liquefaction. The causes cited are often project-specific, but higher labour and material costs are common. Depending on contractual terms and the reasons for the increase, cost overruns are shared between the project sponsor and the EPC company.

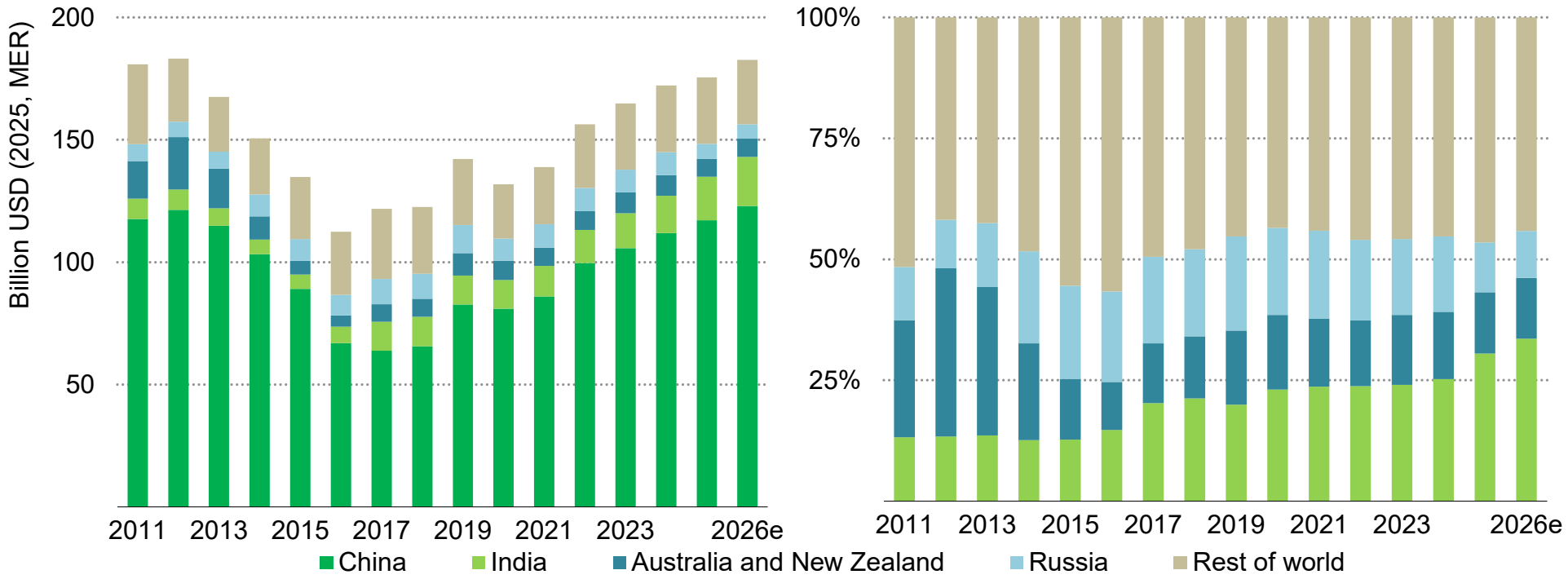
A record 140 bcm of new regasification capacity came online in 2025, with investment spending totalling over USD 20 billion – a 50% rise from 2024. Around half of the investment took place in Europe, largely because of Russia's invasion of Ukraine and the subsequent cuts to pipeline gas supply. In fact, Europe's regasification capacity expanded approximately 30% from 2021 to reach nearly 340 bcm in 2025.

Nevertheless, China has been the single largest investor in regasification capacity in recent years, adding more than 150 bcm since 2021. An additional 14 projects totalling around 60 bcm are at an advanced stage of construction, although approvals for new terminals have slowed as higher domestic gas output and increased pipeline inflows from Russia have reduced LNG import needs. Meanwhile, Viet Nam's regasification plans remain largely stalled, with several LNG-to-power projects cancelled or delayed. In contrast, Thailand, the Philippines and Singapore continue to advance LNG import infrastructure, reflecting strong demand.

Morocco has postponed procurement for its planned USD 1 billion LNG import facilities amid a reassessment of long-term gas requirements. Jordan awarded a USD 125 million contract for a new onshore terminal in 2025 to replace the Aqaba floating storage and regasification unit (FSRU), and Egypt leased three new FSRUs in 2025 to manage demand peaks and offset declining domestic production.

Coal investment has been rising steadily in the past six years, dominated by China and growth in India, albeit from a much lower base

Investment in coal supply (left) and by region excluding China (right), 2016-2026



More than 65% of the USD 180 billion in coal supply investment globally in 2026 comes from China. Investment in India is much lower, but it doubled from 2016 to 2017 and has grown steadily this decade as the country seeks to reduce imports.

Notes: MER = market exchange rate. 2026e = estimated. “Rest of world” includes Africa, Central and South America, Other Southeast Asia, Other Asia, the Caspian region, Europe and North America.

Coal supply investment globally edges up on expansions in China and steady growth in demand

Investment in total coal supply, including both production and infrastructure is expected to be around USD 180 billion in 2026 up 4% from 2025. Although the pipeline of new projects is robust, investment is also directed to refurbishments as capital is being allocated to sustaining capex and modernisation.

Investment in coal production in 2026 is set to increase for both steam coal (+5% from 2025) and coking coal (+3%). Currently, two-thirds of the more-advanced coal projects in the pipeline focus on coking coal extraction, although many of them will produce thermal coal as well. Mixed coking and thermal projects are also becoming more attractive, as weak thermal coal prices and slow development of alternatives to blast furnaces for steel production are strengthening coking coal demand.

About 65% of investment globally in 2026 will take place in China, which registers a 5% rise from 2025, while aggregate investment in all other regions (mainly Australia, Russia, India, Indonesia and the United States) is flat year-on-year.

Investment in steam coal in China is set to surpass USD 100 billion in 2026, nearly double the level of a decade ago. Incremental mine expansions, modernisation and productivity upgrades in Shanxi and Inner Mongolia underpin stable output to 2030. Recent disclosures of coal-to-chemicals and coal-to-gas projects in indicate the continued participation of state-owned enterprises in expanding and modernising the sector.

Australia's coking coal investment of about USD 4.5 billion in 2026 is second only to China's. It has announced two plants to produce 9-10 Mtpa in sellable product and several smaller ones (<4-5 Mtpa), with all to come online over the next decade. Indonesia also maintains substantial export-oriented production, with a limited number of new projects.

Meanwhile, India continues to push domestic production, with Coal India and a host of new companies winning auctions for commercial mines, adding tens of millions of tonnes per year of capacity to reduce imports, even though demand dipped in 2025. India also leads investment growth in coal transport infrastructure, increasing from USD 5 billion to USD 7 billion, and is seeking to expand its coal gasification capabilities to produce chemicals.

In Russia, the Elga phase 2 project will add 25 Mtpa of coking coal, contributing to the USD 6 billion in overall supply spending. Russia has also committed to major railway and seaport expansions to deliver coal to China, Korea and Japan.

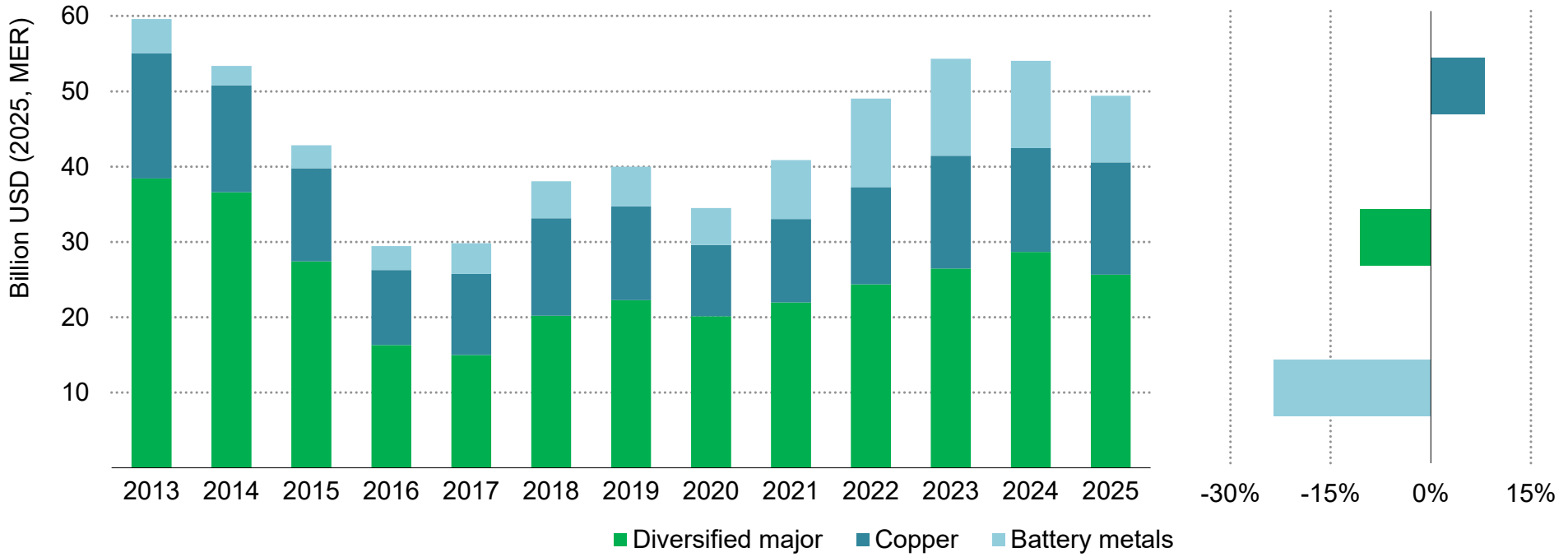
The United States and Canada have streamlined their approval processes, helping expand the regional project queue to 15 mines with a combined 34 Mtpa of planned capacity. In Canada, at least six major projects advanced in 2025. In the United States, Ramaco's Maben complex could reach 2 Mtpa, Alliance's River View extension began operating in 2024, and Warrior Met Coal's Blue Creek project (designed for 4 Mtpa) started sales in 2025 as the only greenfield capacity addition.

In Africa, South Africa has brought two projects online since 2024, and its 12 additional ongoing mine projects total 31 Mtpa.

Critical minerals

Critical mineral investments fell in 2025 after several years of growth, with the strongest decline affecting battery metal companies

Capital expenditures for non-ferrous metal production by major mining companies, 2013-2025 (left) and 2024-2025 change (right)

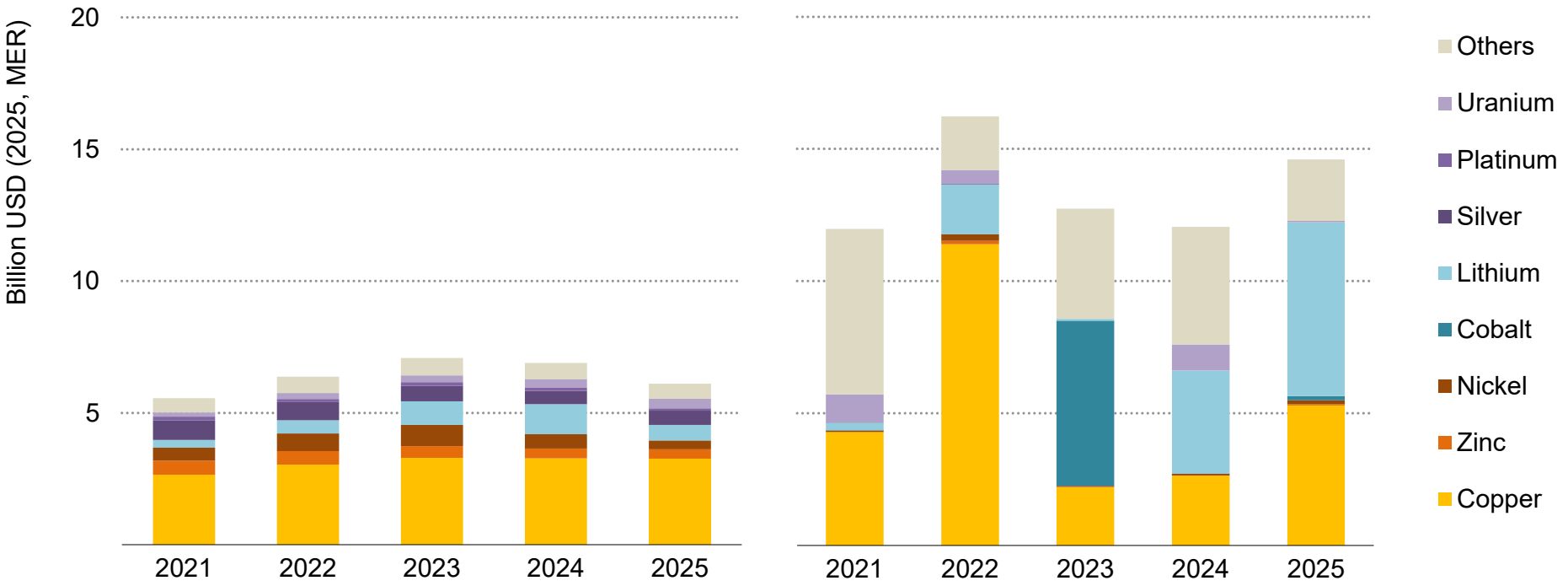


Investment in critical mineral mining fell 9% in 2025, with the largest drops affecting battery metal companies. Meanwhile diversified majors saw only modest decreases and copper companies saw an increase.

Notes: MER = market exchange rate. Covers 24 major mining companies. Values exclude budgets for iron ore, coal, aluminium, gold and diamonds.
Source: IEA analysis on company reporting and S&P Global (2026).

Exploration spending continued to decline in 2025 while mergers and acquisitions increased, mainly in copper and lithium

Exploration spending (left) and M&A activity (right) for selected non-ferrous mineral resources, 2021-2025



Notes: MER = market exchange rate. M&A = mergers and acquisitions. Mergers and acquisitions activity takes only completed transactions into account and is categorised according to the acquired company's primary commodity. "Others" comprises cobalt, rare earth elements, potash/phosphate and many other minor metals. Excludes iron ore, coal, aluminium, gold and diamonds.

Source: IEA analysis on company reporting and S&P Global (2026).

Critical mineral investment became more selective in 2025, with interest in battery metals weakening while copper remained strong, reflecting its central role in electrification

Critical minerals underpin energy systems through their use in batteries, permanent magnets and electricity grids, as well as in a growing range of technologies including digital infrastructure, artificial intelligence and data centres.

After several years of rapid growth, however, investment in critical minerals slowed in 2025. Our assessment of almost 25 large mining companies indicates that capital expenditure fell 9% year-on-year, marking the first substantial decline since 2020. While underlying demand remains strong and prices for some critical minerals began to recover during 2025, high risks associated with market concentration, price volatility and technological uncertainty led investors in critical mineral supply chains to adopt a more cautious stance. The sharp price increases observed between 2021 and 2022, followed by renewed volatility in 2024-2025, exposed structural vulnerabilities in critical mineral supply chains and highlighted how disruptions can propagate across systems.

Investment trends vary markedly by company type and commodity. Companies focused on battery metals – lithium, nickel and cobalt – experienced the largest decline in capital spending in over 10 years (over 20%). Lithium specialists in particular reduced investment by about 40%, following strong growth for the last several years. Shifts in battery chemistry preferences, oversupply-driven price weakness and policy uncertainty in major markets have weakened investor confidence in battery metal markets.

Meanwhile, diversified majors scaled back their spending more modestly and companies focused primarily on copper registered an increase of 8% year-on-year, underscoring investor confidence in copper's long-term demand given its central role in electrification.

Mineral exploration and M&A activity also reflect these patterns. Critical mineral exploration spending fell 10% in 2025. Again, this slowdown was commodity-specific: copper continued to be the main focus of exploration budgets, with spending remaining broadly steady year-on-year. Lithium and nickel, however, both had notable drops of around 40%. For lithium, this largely reflects subdued prices following rapid supply expansion in recent years, while for nickel it is the result of rising uncertainty linked to battery chemistry shifts and future demand profiles. Across regions, the largest declines in exploration spending were in Australia and the United States (around 25%), whereas Asia Pacific recorded a 20% increase.

In M&A activity, overall deal value rebounded in 2025, though the increase resulted largely from one single USD 6.3 billion deal between Rio Tinto and Arcadium Lithium. Behind this rise, divergence across commodities is very pronounced. Spending on

copper assets doubled between 2024 and 2025 owing to consolidation and competition for high-quality resources, reflecting copper's strategic importance and the concentration of high-value assets. In contrast, deal activity in battery metals remained subdued beyond the Rio Tinto-Arcadium transaction, highlighting weaker investor sentiment amid price volatility and uncertainty.

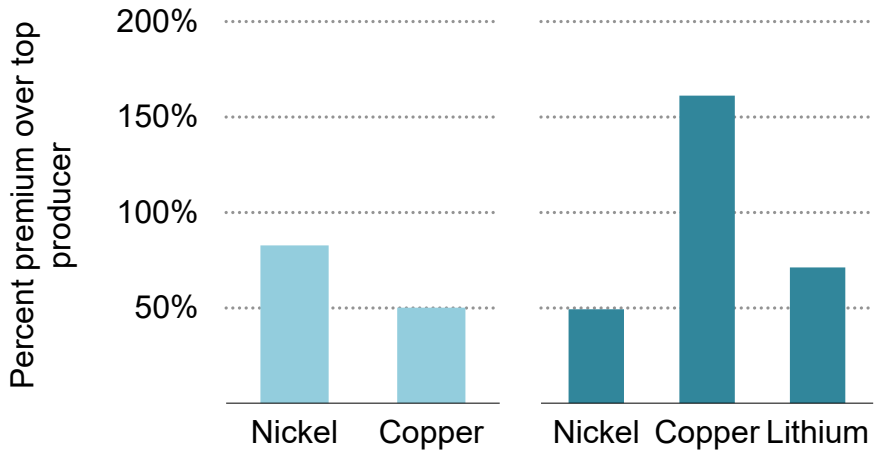
While critical minerals are vital for both energy and economic security, supply chain concentrations have never been higher, particularly for refining and processing. For instance, China holds an average market share of over 70% for 19 of the 20 prominent strategic minerals, including copper, lithium, cobalt, graphite, rare elements and other strategic minor metals. This is the result of a long history of investing in critical mineral supply chains, largely through policy-backed financing vehicles underpinned by policies such as the Belt and Road Initiative and the 14th Five-Year Plan, or support from state-owned commercial banks such as the Bank of China.

To gain access to upstream resources, China has traditionally relied on limited-recourse project finance structures, whereby lending portfolios support upstream project companies, including special-purpose vehicles (SPVs) and joint ventures (JVs). By providing loans to JVs and SPVs when Chinese companies have equity stakes, China helps ensure that raw or processed mineral outputs from overseas projects are channelled back to the country for further processing. During periods of heightened price volatility, this financing structure also keeps upstream production commercially anchored to Chinese refineries, insulating downstream processers from supply disruptions, limiting exposure to spot market swings and reducing revenue uncertainty for upstream projects.

This approach underpinned around USD 57 billion in investment in upstream production across copper, nickel, lithium, cobalt and rare earth elements in almost 20 emerging markets and developing economies from 2000 to 2021. In parallel, China has made substantial domestic investments in geological exploration, exceeding over USD 15 billion across all minerals, and has continued to expand refining and processing capacity both domestically and through overseas investment, reinforcing its central role across multiple stages of critical mineral supply chains.

Naturally, attention has turned towards how to diversify critical mineral supply chains away from just one dominant player since the risks became apparent in 2025. However, despite the strategic importance of critical minerals, persistent financing challenges impede investment in diversified supply chains. The most fundamental constraint is the structural cost differential between projects in incumbent regions and those in diversified jurisdictions.

Initial capital costs in regions with diversified supply compared with the top producing region for mining (left) and refining (right)



Source: IEA analysis based on company reporting.

Upfront capital costs for projects in diversified regions are higher on average than for today's leading producers. New developers often contend with smaller project scales, higher energy and labour costs, more stringent environmental requirements and weaker supporting infrastructure, widening the cost gap relative to incumbent producers. These upfront cost differentials are particularly challenging for projects in emerging and developing economies, where many governments are seeking to expand their role in global critical mineral supply chains, but higher perceived risks and weaker enabling conditions can complicate financing and investment decisions.

Furthermore, price volatility (which is particularly pronounced in nickel, cobalt and rare earths markets) amplifies these cost challenges. Large and frequent swings in market prices undermine revenue certainty and increase the cost of capital, affecting both existing operations and new entrants. Operators struggle to maintain margins during price dips, while prospective projects find it difficult to secure debt and equity financing without guarantees of future revenues. Developers outside of dominant regions typically lack vertically integrated customer relationships, long-term contracts or state-backed support to help absorb volatility elsewhere.

Difficulty securing predictable and bankable offtake is a third investment barrier in diversified regions. Downstream buyers are often risk-averse and do not want to commit to long-term contracts with new suppliers, particularly if there are cost differentials; if data are of limited quality; and if future demand or technology pathways are uncertain.

Many critical-mineral markets also suffer from low liquidity and weak price discovery, particularly smaller-scale, less-standardised metal markets such as some battery metal markets (e.g. lithium and cobalt) and minor, nascent metal markets (e.g. rare earths and gallium). Opaque bilateral contracts often dominate in these markets, and reliable price benchmarks are scarce. Even when indices exist, they may fail to reflect actual prices in the market. In contrast, bulk materials such as copper and nickel benefit from exchange-trade benchmarks that facilitate hedging and financing, though recent price spikes in both markets have highlighted vulnerabilities.

As a result, it is often challenging for these markets to access traditional financing channels. Long lead times, technical complexity (especially in separation, refining and metallurgical processes) and small project size can make it difficult for ventures to meet the tolerance threshold of mining majors, export credit agencies and commercial banks.

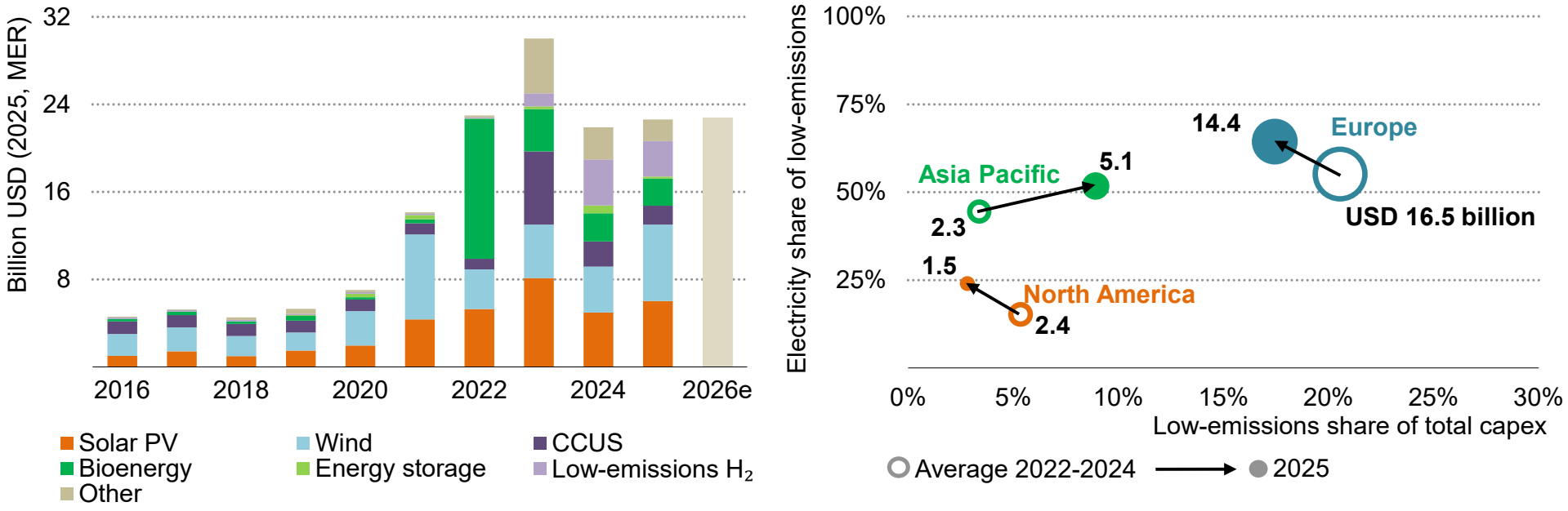
Given the strategic importance of critical minerals and the financing challenges facing many projects, governments are increasingly deploying public finance to derisk investment across supply chains, particularly in strategically important markets and for early-stage projects. Support has included financing in the form of direct equity, such as the US government's USD 400 million stake in MP Materials for rare earths and the UK Infrastructure Bank's USD 32 million direct investment in Cornish Lithium. Others are offering concessional financing, loan guarantees and grants to reduce early-stage capital burdens and improve bankability, such as Australia's USD 1.2 billion concessional loan to Eneabba Refinery and France's USD 124 million grant to Carmean (a subsidiary of Carester).

Along with employing supply measures, governments are looking at deploying demand-side interventions to support investment in critical mineral supply chains. Approaches include demand aggregation, strategic stockpiling and facilitated offtake arrangements aimed at improving revenue certainty and reducing commercial risk.

Low-emissions fuels

Low-emissions investment by oil and gas companies is growing again following a significant drop in 2024, with an increasing focus on direct generation

Investment by low-emissions technology (left) and allocation metrics by selected headquarter region and period (right)



Wind and solar PV accounted for over half of the USD 22.6 billion invested by oil and gas companies in low-emissions technologies in 2025. European companies led investment levels, while Asia-Pacific peers more than doubled their share from the 2022-2024 average.

Notes: MER = market exchange rate. 2026e = estimated. CCUS = carbon capture, utilisation and storage. H_2 = hydrogen. "Other" includes low-emissions transport infrastructure, geothermal, hydropower, lithium, and mergers and acquisitions. Electricity-related investments cover wind, solar PV, hydropower and geothermal. All dollars are inflation-adjusted to 2025 real dollars. For regional definitions, see the Methodology Annex.

Sources: IEA analysis based on Bloomberg (2026), Bloomberg Terminal; Clean Energy Pipeline (2026), Clean Energy Pipeline homepage; and companies' annual reports and presentations.

Oil and gas companies other than majors comprise an increasing share of total low-emissions investment as diverging strategies reshape company and regional contributions

The oil and gas sector reported investment of around USD 23 billion in low-emissions energy technologies in 2025, a marginal increase from 2024 and roughly 25% below the 2023 peak. Company guidance and investment plans suggest that 2026 estimated investment will remain in the USD 22-24 billion range.

Low-emissions spending accounted for close to 4% of the sector's total capital expenditure in 2025, a slight increase from 2024, with wide variation across companies. European majors, including Equinor and Repsol, reduced the share of capital allocated to low-emissions activities following recalibrations towards upstream operations, with the average share declining from 23% in 2024 to 18% in 2025. Both ExxonMobil and Petrobras also recently revised their five-year guidance on low-emissions investment, scaling back their targets by around 30%. Chevron removed its previously explicit USD 10 billion lower-carbon capital spending plan for 2021-2028.

TotalEnergies is an exception to this trend, with its share of capital allocated to low-emissions investment growing 30%. Most of the counterbalance, however, comes from non-majors, particularly NOCs such as PetroChina, PTT Exploration and Production (PTTEP) and Saudi Aramco, which continue to increase both the absolute level and relative share of their low-emissions investments, directly or via wholly owned subsidiaries.

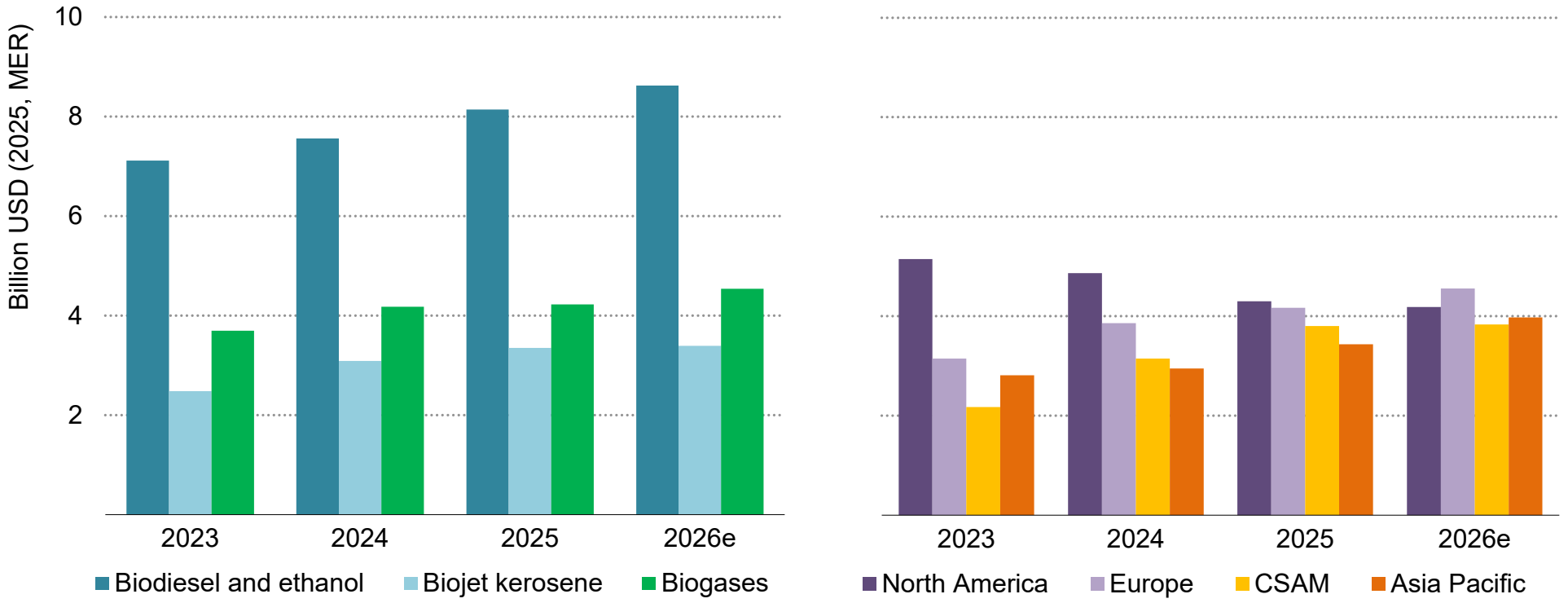
Wind and solar PV dominated the technology mix in 2025. Wind investment remained concentrated among European projects, while global mix (65% of companies assessed) invested in solar PV. Despite growth in 2025 for wind energy, it was a turbulent year for the technology: Equinor's offshore Empire Wind project received two stop-work orders before a US court allowed construction to resume in January 2026, and the US Department of the Interior refunded TotalEnergies following the termination of two offshore wind leases.

Geothermal energy is also attracting investment: Devon Energy has made a second consecutive annual investment in Fervo Energy, which raised over USD 1 billion between 2022 and 2025 and recently went public, while OMV targeted 1 TWh of generation by 2030. Investment is also expanding for low-emissions transport infrastructure, particularly in China, where Sinopec and PetroChina established partnerships to deploy EV battery-swapping networks.

A number of companies are also pursuing low-emissions strategies focused on CO_2 and fuels. ExxonMobil commenced CCUS operations at its Donaldsonville complex in 2024 and is progressing towards a final investment decision to supply a data centre with abated gas-fired power. Meanwhile, the biofuel investment plans of ENI and PETRONAS are advancing through both greenfield developments and refinery conversions.

Total investment in liquid biofuels and biogases is set to rise 5% in 2026 to more than USD 16 billion, building on the 6% increase in 2025

Investment in liquid biofuels and biogases by type (left) and in selected regions (right), 2021-2026e



Investment in liquid biofuels and biogases is set to reach almost USD 16 billion in 2026, reflecting growth in Asia Pacific and Europe, and in liquid biofuels.

Notes: MER = market exchange rate. CSAM = Central and South America. 2026e = estimated. “Biogases” includes biogas and biomethane.

Policy support underpins rising investment in liquid biofuels in 2026 as projects face economic hurdles

Investment in liquid biofuels and biogases in 2026 is set to climb 5% year-on-year to a record high of more than USD 16 billion, similar to the 6% increase from 2024 to 2025. Most of the growth comes from liquid biofuels in Asia Pacific and Europe.

Projects hinge on policy support, with some measures especially for sustainable aviation fuel (SAF) advancing while others stall. Notable developments in 2025 were the EU ReFuelEU aviation's 2% binding blending requirement and the US 45Z Clean Fuel Production Credit coming into force in January. Along with other national support measures, these policies are expected to further stimulate investment in biojet kerosene. In contrast, the postponement of the IMO Net-Zero Framework in October 2025 increased shipping sector uncertainty.

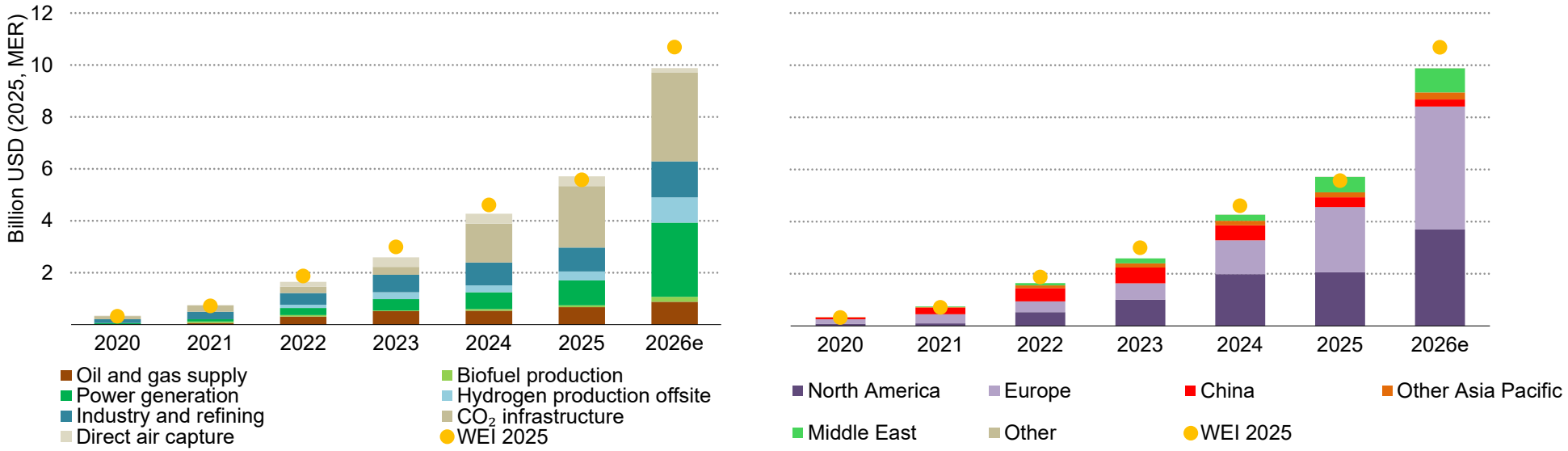
These policy shifts have accelerated SAF activity. In 2025, TotalEnergies announced plans to scale up production to 500 kt/yr by 2028. Its Grandpuits biorefinery, currently undergoing a USD 600 million conversion, is expected to begin producing 230 kt/yr this year. Other projects are also moving forward: for instance, construction started on a biorefinery in Malaysia to process 650 kt/yr of renewable feedstock, led by PETRONAS, Enilive and Euglena. In Italy, ENI reached FID in early 2026 on a biorefinery in Lombardy, backed by a USD 600 million 15-year loan from the European Investment Bank. The plant is set to start processing 550 kt/yr to produce hydrotreated vegetable oil (HVO) and SAF in 2028. A year earlier, ENI secured a similar loan to convert a Livorno refinery.

Yet, liquid biofuels projects continue to face economic hurdles, with several developers reporting challenges in achieving commercial viability. In September 2025, Shell announced the cancellation of its 820 kt/yr HVO and SAF facility in Rotterdam due to insufficient competitiveness, one year after halting construction. The company now expects a USD 600 million impairment, bringing total write-downs to around USD 1.4 billion. Some governments are stepping in to mitigate these economic pressures. In September 2025, Australia announced a USD 850 million Cleaner Fuels Program, designed to support project viability.

With closure of the Strait of Hormuz triggering fuel shortages, the use of domestic biofuels to bolster energy security has gained attention. Since March, governments have been introducing or accelerating policies to enlarge liquid biofuels use. For instance, three months after its biodiesel plan had been postponed due to high funding costs, Indonesia announced it would boost its mandate from B40 to B50 starting July. Several other countries have also raised their blending mandates or maximum allowable blending rates for gasoline, diesel and jet fuel to cut fossil fuel import bills, though these measures have raised concerns about competition with food crops.

Expected investment from committed CCUS projects has been revised down for this year, despite a substantial project pipeline

Investment required for committed CCUS projects by type (left) and region (right), 2020-2026e



CCUS investment is concentrated in North America and Europe and are mainly for CO_2 capture from power generation, transport and storage. Compared with the WEI 2025 assessment, spending in 2026 has been lowered as project schedules have changed.

Notes: MER = market exchange rate. 2026e = estimated. CCUS = carbon capture, utilisation and storage. “Other” includes Africa and Central and South America. “WEI 2025” represents projected investment based on committed projects in World Energy Investment 2025. Investments include commercial capture facilities with a capacity of over 0.1 Mt CO_2 per year. Committed projects are those with a final investment decision as of 17 March 2026. Future spending levels are based on stated capacities and operational dates and assume no new project announcements (or delays or cancellations).

Sources: IEA analysis based on recent announcements; and IEA (2026), CCUS Projects Explorer database (accessed 2 April 2026).

Investment in CCUS has accelerated sharply in recent years and is set to reach record levels in 2026, but the outlook remains heavily contingent on supportive policies

Recent data indicate that expected CCUS investment in 2026 has been revised down compared with the WEI 2025 outlook, reflecting delays and schedule revisions across a number of projects. These adjustments are primarily related to the timing of project delivery rather than a deterioration in underlying policy or industrial interest. In Europe, for example, several large transport and storage projects – including parts of the United Kingdom's East Coast and HyNet clusters – have had their investment timelines extended because first-of-a-kind infrastructure, contracting arrangements and final government support mechanisms have taken longer to finalise. After years of slow progress, CCUS is moving into a new phase in which a limited number of large-scale projects are advancing from planning to construction, notably in transport and storage infrastructure and selected industrial applications.

Recent financial-close and transaction activity underscores this shift from announcements to investable projects. In Europe, several "hub" and transport- and storage-led developments have secured landmark financing packages and commercial arrangements (e.g. the Northern Endurance Partnership/Net Zero Teesside and HyNet ventures), while project-level transactions are also emerging for capture in industry and district heating (including the Stockholm Exergi development). Beyond committed projects, most announced CCUS projects remain at an early stage of development. Around 90% of them have yet to reach FID, and a number of projects that were previously announced have been delayed or withdrawn due to financing and commercial challenges. Compared with last year's assessment, project timelines have been pushed back, shifting a growing share of announced capacity into the mid-2030s, and capital costs have risen above earlier expectations.

This primarily reflects schedule revisions and financing challenges rather than a deterioration in underlying policy or industrial interest, particularly for first-of-a-kind capture projects and transport and storage infrastructure in Europe. Cost uncertainty and execution risks are significantly higher for first-of-a-kind projects, particularly during the early deployment phases, underscoring the financing challenge for initial investments in hard-to-abate sectors. These dynamics reduce near-term investability, even as the long-term project pipeline remains sizeable.

New investor types are beginning to participate through equity and infrastructure-style deals (including private equity participation in CCUS platforms), and the first green bond issuance linked to a CCUS project (Porthos) points to a gradual broadening of financing instruments.

Strong public support underpins this renewed momentum. Governments have earmarked more than USD 50 billion for CCUS projects through a variety of mechanisms over the past three years,

reflecting growing recognition of the value of CCUS in reducing emissions from hard-to-abate sectors and enabling carbon dioxide removal. Importantly, the nature of this support is evolving. While early deployment relied heavily on upfront capital grants, recent projects increasingly depend on long-term revenue and risk-sharing mechanisms, such as contracts for difference, regulated transport and storage tariffs, and tax credit regimes. These instruments aim to improve revenue predictability and crowd in private capital while limiting immediate fiscal outlays.

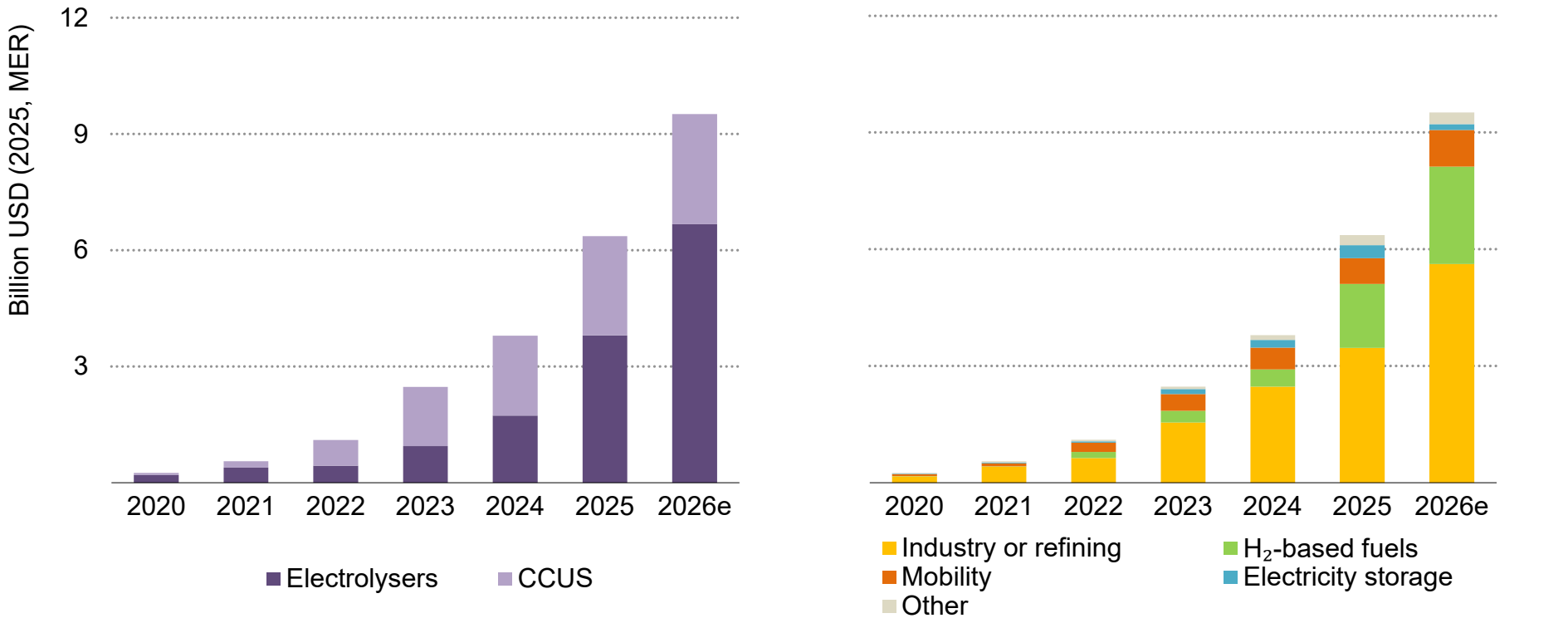
Based on recent IEA analysis, private capital participation is beginning to expand, particularly through project finance and commercial debt. In the past two years, more than USD 15 billion of private debt has been raised for CCUS projects, marking a significant step towards broader financial market engagement. However, this participation remains highly concentrated. Most transactions have occurred in a small number of jurisdictions with strong policy frameworks, and typically involve large projects supported by predictable revenues and clear risk allocation across the capture, transport and storage value chain. Capital intensity, cross-chain dependencies and long-term liability continue to constrain wider private investment, so large lending syndicates are often required even for a single project.

CCUS in general does not benefit from a natural market for its core service (the permanent storage of CO_2) and therefore remains highly dependent on policy-enabled business models. Projects targeting carbon dioxide removal and hydrogen production with CCUS have faced particular difficulty in securing firm offtake arrangements, limiting their ability to attract private finance at scale. In carbon dioxide removal, particularly direct air capture (DAC), first-of-a-kind DAC systems involve capture costs estimated at USD 500 to USD 1 900 per tonne of CO_2, reflecting early-stage designs and limited deployment experience. Around USD 1 billion of public R&D funding has been mobilised to support first-of-a-kind and pilot projects, with the expectation that advances in capture materials, process efficiency and economies of scale could reduce costs to around USD 300 per tonne of CO_2 by mid-century.

Investment patterns also vary significantly by region. Europe has emerged as the most dynamic growth region, with multiple projects reaching financial close as governments shift towards revenue-based support and assume a greater role in managing long-term risks. In North America, investment has been driven primarily by tax incentives and carbon credit arrangements, favouring projects with relatively low capture and transport costs. Elsewhere, including much of Asia and the Middle East, CCUS development has been led mainly by state-owned or large oil and gas companies using balance-sheet financing, with more limited participation from commercial lenders.

Low-emissions hydrogen investment will rise by 50% in 2026 if all committed projects proceed

Average annual investment from committed projects in low-emissions hydrogen supply by type (left) and intended use (right), 2020-2026e



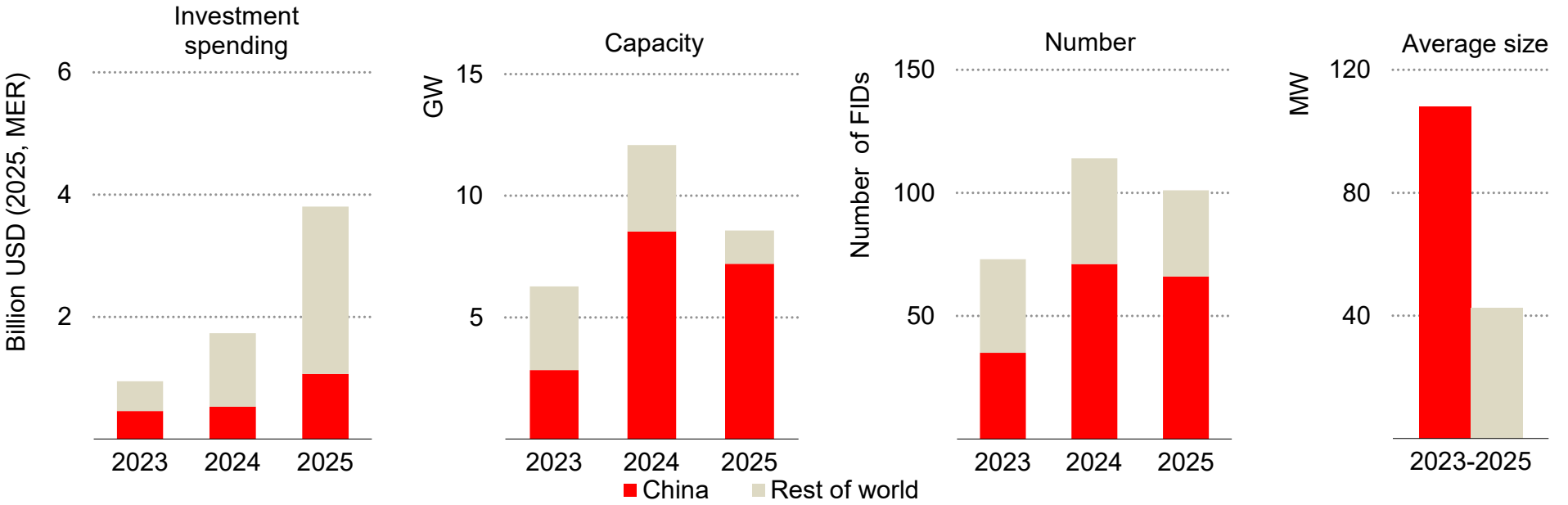
Investment in low-emissions hydrogen production will reach almost USD 10 billion in 2026 as projects that have reached FID advance, with investment in electrolysis-based production accounting for more than 70% and most spending aimed at existing applications.

Notes: MER = market exchange rate. 2026e = estimated. CCUS = carbon capture, utilisation and storage. H_2 = hydrogen. Committed projects are those with a final investment decision as of April 2026. Other intended uses include biofuel upgrading, grid injection, combined heat and power and domestic heating. Values for new CCUS-equipped H_2 projects include base-plant costs.

Sources: IEA analysis based on recent announcements; and IEA (2026), Hydrogen Production and Infrastructure Projects Database (accessed on 18 May 2026).

China accounted for less than 30% of global electrolyser investment in 2025 but 65% of electrolytic hydrogen capacity under construction, reflecting its much lower capital costs

Investment spending on electrolysers, and electrolytic hydrogen project FIDs by capacity, number and average size, 2023-2025



In 2025, China had 18 GW of electrolytic hydrogen capacity under construction, including 7 GW that reached FID that year. The country's projects stand out globally for their scale and volume, as well as lower capital costs.

Notes: MER = market exchange rate. The 2.2-GW NEOM project in Saudi Arabia and the 1.3-GW Kakinada project in India (FID in 2023 and 2024) were excluded from the average size to avoid skewing the mean upward by 30 MW, given that the next-largest project is 740 MW and the remaining projects are below 350 MW.

Sources: IEA analysis based on recent announcements; and IEA (2026), Hydrogen Production and Infrastructure Projects Database (accessed on 18 May 2026).

With record-level FIDs in 2024, low-emissions hydrogen investment is set to reach a new high in 2026, even as uptake uncertainties, delays and cost inflation trigger a slowdown in new FIDs

Spending on low-emissions hydrogen is anticipated to rise 50% in 2026, to nearly USD 10 billion, reflecting the large number of projects that reached FID in 2024. Still, there are headwinds facing the sector and FID activity slowed in 2025 and the first half of 2026. Spending on hydrogen supply projects in 2026 will be highest in Europe (33% of the global total), the United States (19%) and China (18%). For electrolysers, Europe and China have the greatest capital spending, whereas in the United States, nearly all investment goes to CCUS-equipped production.

Electrolysis is set to account for 70% of total spending in 2026 (up from 60% in 2025) compared with 65% of estimated production volume under construction, reflecting its higher capital intensity. The growth slowdown for CCUS-equipped facilities results partly from completion of the CF industries facility in Louisiana in July 2025, a major project valued at over USD 200 million.

Weak demand is stalling low-emissions hydrogen projects globally, as they are unable to advance without firm long-term offtake agreements. As a result, several projects – including some that had reached FID – have been paused or delayed. For instance, Dow's low-emissions hydrogen-based chemical plant in Alberta (USD 6.5 billion excluding governmental incentives and subsidies) has now been delayed by up to two years. Even in markets with government-backed demand frameworks (e.g. the United Kingdom), several announced CCUS projects have been cancelled. In Chile, weaker-than-expected global demand and delays prompted the government to lower production targets in early 2026. Production cost estimates were also increased.

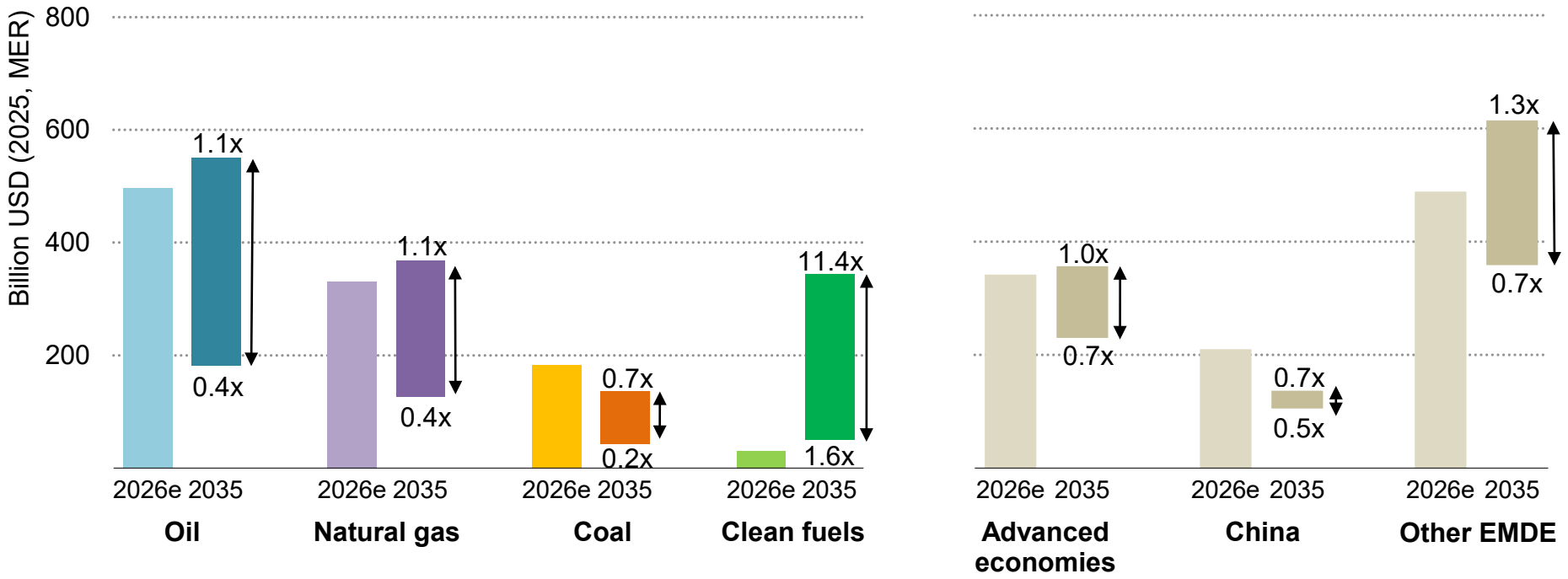
China is also facing weaker-than-expected domestic demand, yet it remains the dominant market for new electrolytic capacity reaching FID (85% of the 9 GW in 2025) and accounts for almost two-thirds of global capacity under construction. Hydrogen is framed as a strategic priority in China's 15th Five-Year Plan (2026-2030) with targets to boost domestic consumption. Construction has begun for phase 2 of a gigawatt-scale ammonia and methanol electrolyser project in Jilin, with the cost estimated at around USD 3.3 billion including power generation. At the same time, some Chinese manufacturers are also expanding overseas: in 2026, GuofuHee partnered with a local firm to build a 250-MW electrolyser facility in Germany.

Delays are also amplifying cost inflation risks. In May 2025, Air Products delayed the startup of its Louisiana Clean Energy Complex project from 2026 to 2028/2029 and decided to divest itself of the CCS and ammonia elements of the project. Total cost for the integrated complex is now estimated at around USD 8-9 billion – double the USD 4.5 billion announced during early planning.

Implications

Investment in fuels varies widely across IEA scenarios, but today's policy settings imply the continuity of current trends

Supply investment by category (left) and region (right) in 2026e, and scenario ranges for 2035



Between now and 2035, clean fuel investment increased across all scenarios while other fuels see a range of possible investment outcomes. Possible increasing would be concentrated in EMDE.

Notes: 2026e = estimated. EMDE = emerging market and developing economies. Minimum and maximum 2035 investment values correspond to different levels of ambition under scenario modelling.

The effects of the Middle East conflict compound uncertainty over future investment requirements for fuels

Benchmarking today's investment levels against IEA scenario requirements reveals a wide range of future outcomes and uncertainties, even before effects of the current conflict in the Middle East are factored in.

The exploratory scenarios in World Energy Outlook 2025, which are based on different readings of prevailing policy settings prior to the Middle East conflict, demonstrate a high degree of continuity in investment levels for oil and gas. Between 2025 and 2035, annual oil and natural gas supply investments decrease roughly 5% in the Stated Policies Scenario (STEPS) as new LNG capacity additions partially counterbalance uncertainties around oil demand. Under the Current Policies Scenario (CPS), however, these investments increase about 7%.

Nevertheless, drops in production at existing fields – not demand differences – are the main determinant of oil and gas investment. Nearly 90% of upstream investment today is dedicated to offsetting declines rather than expanding capacity. In fact, decline rates in existing oil and gas fields pose major risks if adequate investment is not maintained.

IEA analysis of around 15 000 fields worldwide shows that natural decline rates are becoming steeper, mainly because of a higher share of shale formations and offshore fields in oil and gas supply. If all capital investment in current oil and gas production were to cease immediately, global oil production would fall by around 5.5 mb/d each year and natural gas output by 270 bcm. In 2010, these figures were 3.9 mb/d and 180 bcm respectively.

This analysis is all the more pertinent if the oil and gas supply disruption in the Middle East continues, as the large Middle Eastern fields exhibit the slowest observed declines. If investment and production shift away from the Middle East to other parts of the world because of the conflict, the oil and gas industry will need to work even harder to maintain supply adequacy.

However, IEA normative scenarios offer an alternative assessment of the future, with policymakers achieving specific long-term objectives to bring down emissions. In these scenarios, investment in the electrification of energy service demand, in efficiency and in low-emissions sources of power (nuclear and renewables) gains pace much more quickly than in the exploratory scenarios. As a result, oil and gas demand is considerably lower, reducing – but not removing – the need for continued investment in oil and gas supply. Energy security considerations could reinforce the momentum to deploy some of these technologies in the aftermath of the current crisis, particularly in fuel-importing countries that wish to insulate themselves against future price volatility.

A finding that is common to all scenarios is reduced spending on coal, but this conclusion may also require careful review in light of today's crisis. As coal is the most carbon-intensive of all the fuels, there are pressing environmental reasons to reduce its use. But as it is also relatively abundant in many Asian countries that are being hit hard by the current disruption, it might also be considered an energy security asset.

Following the first oil shocks in the 1970s, many countries turned to coal to diversify away from oil in power generation (the first major wave of nuclear investment also occurred during this period). Investment in coal-fired power thus surged in the 1970s: in the ten years after 1973, coal-fired capacity around the world rose more than 50%. However, a reaction of similar magnitude is highly unlikely today because there are many cost-competitive options to produce electricity with lower emissions than coal, but countries may nonetheless revisit their strategic assessment of coal's place in their future energy mix.

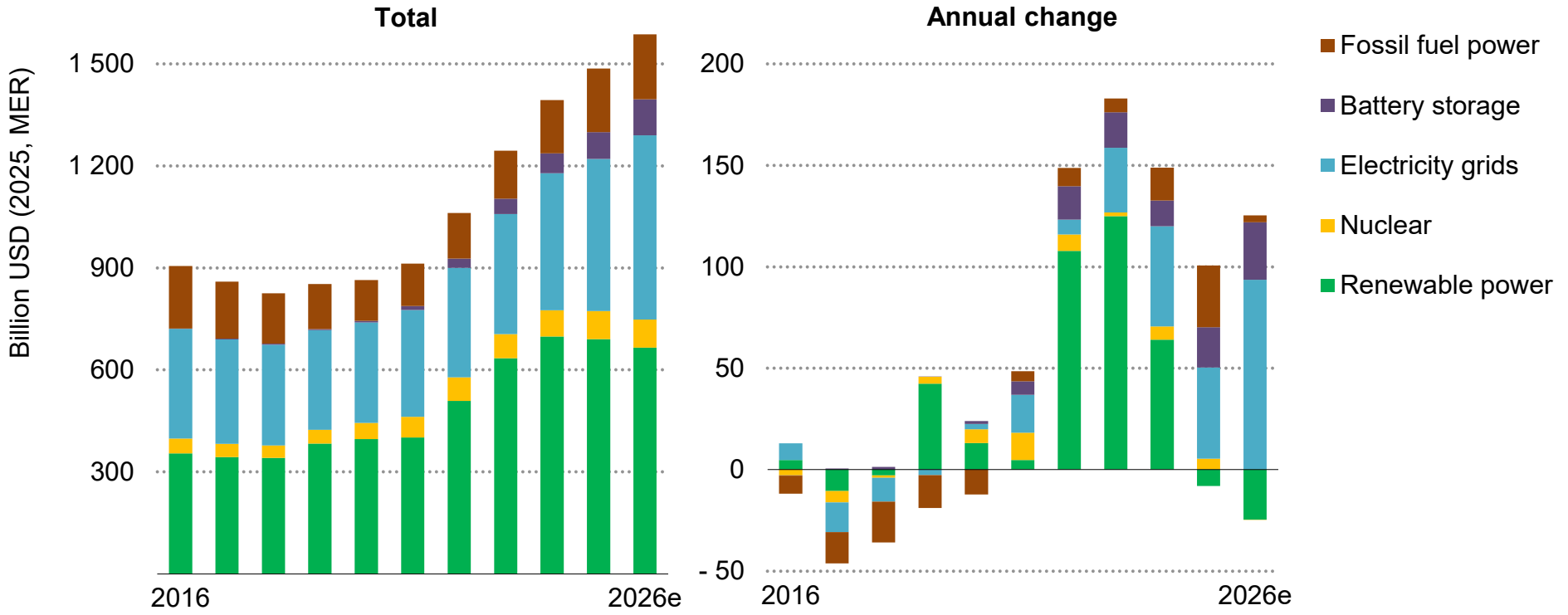
Investment in low-emissions fuels rises in all our scenarios, but these fuels (and technologies in the case of CCUS) face competing pressures as a result of the current crisis. For instance, elevated prices and higher risk perceptions for fossil fuels may make low-emissions fuels more attractive as strategic options for governments, particularly biofuels that can be produced using domestic resources. However, in almost all cases these fuels require strong policy support from governments, and this crisis has exerted even greater pressure on already-constrained fiscal resources. So, while the crisis may have enhanced the case for low-emissions fuels, it has also constricted the means to deploy them in the energy mix at scale.

Power

Overview

Total power sector investment rose an impressive 7% in 2025 despite a slow-down in renewables

Global annual power sector investment (left) and net growth (right) by category share, 2016-2026e

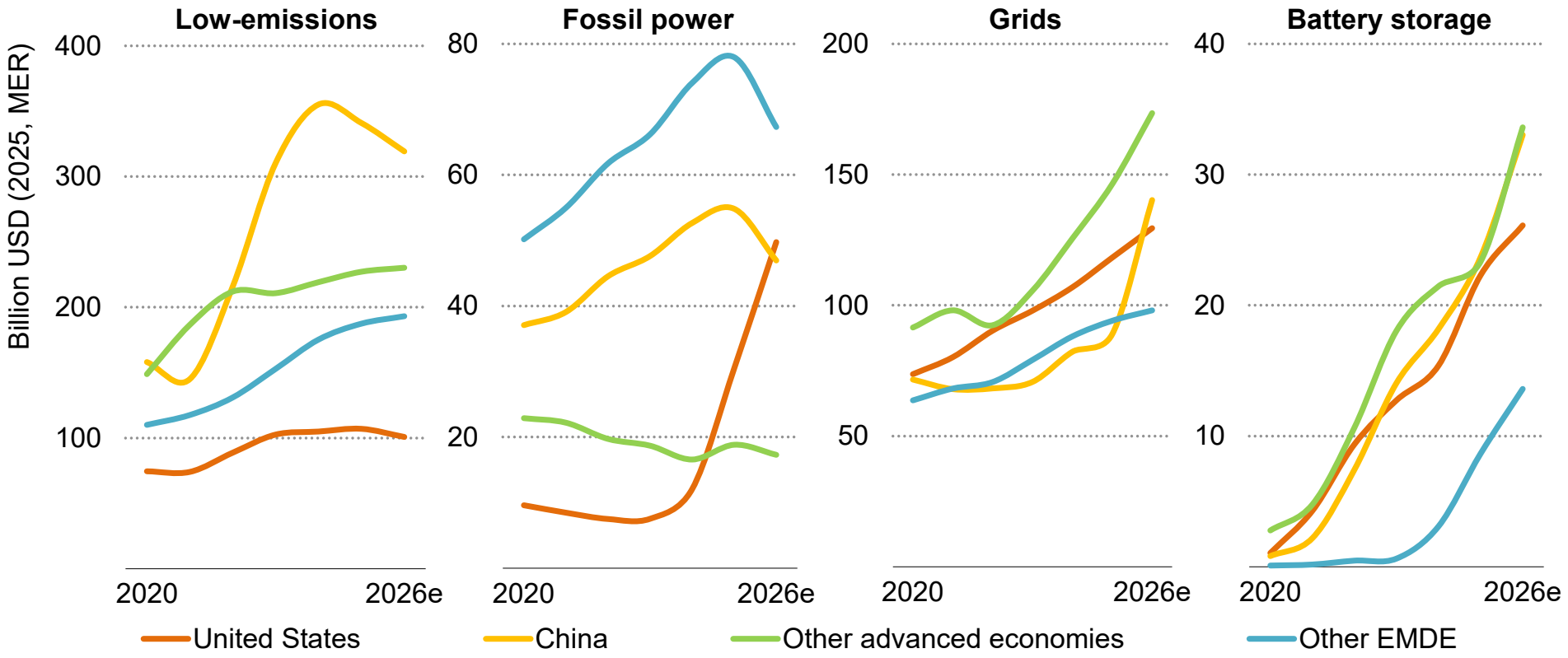


A decline in renewables investment, due in large part to cost reductions, was offset by robust growth for battery storage, grids and fossil power in 2025 – a trend that is expected to continue into 2026.

Notes: MER = market exchange rate. 2026e = estimated. Investment throughout is measured as ongoing capital spending on new and existing power capacity. “Fossil fuel power” includes unabated and abated power. Pumped hydro storage is included in “renewable power”, not “battery storage”.

Battery and grid investments continue to rise across most regions, but trends for power generation are diverging in response to policy changes and new demand drivers

Annual investment growth by country or region and category, 2020-2026e



Accelerated load growth and higher solar and wind penetration are boosting spending on grids and batteries in most regions, but policy changes and the data centre boom have shifted China and the United States onto new trajectories for generation capex in recent years.

Notes: MER = market exchange rate. 2026e = estimated. EMDE = emerging market and developing economies. “Low-emissions power” refers to renewables, nuclear, renewable waste, fossil power with CCUS, and generation from low-emissions ammonia or hydrogen. “Fossil power” is unabated fossil power (i.e. coal, gas and oil without CCUS).

Power sector investment was robust in 2025, with divergent regional trends

Total power sector investment rose 7% to USD 1.5 trillion in 2025, primarily reflecting higher spending on electricity grids, battery storage, wind and gas-fired power. Solar and wind remained by far the largest destination for new capital, accounting for 40% of total power sector investment and over 60% of generation investment in 2025. Despite strong growth in capacity additions for both solar PV (12%) and wind (39%) in 2025, recent data indicate a slowdown in renewables deployment in upcoming years due to evolving policy conditions and pricing reforms in some markets. A smaller pipeline of renewables projects under construction, in tandem with continued declines in equipment prices, contributed to the fall in renewables investment in 2025. This is expected to continue into 2026, although there is potential upside for renewables from the current crisis.

A consistent development across most markets is rising electricity grid investments (+11% in 2025 from 2024 levels), which are needed to meet growing demand, integrate more variable renewable energy and ease network congestion. A caveat to this shift is that we cannot confidently attribute the full increase in grid investment to faster deployment or higher volumes of infrastructure being delivered, given rising grid equipment prices. Indeed, data from the United States and Europe show that grid costs have continued to outpace inflation in recent years, and prices for key inputs like copper continue to rise into 2026.

Another area in which investment has grown rapidly is battery energy storage systems (BESS). BESS investment has been rising more quickly in countries where evolving market dynamics from variable renewable energy penetration – especially more frequent periods of negative prices and curtailment – have created a clear business case for shifting energy during times of surplus generation. Investment is also expanding rapidly in other regions: emerging market and developing economies (EMDE) excluding China accounted for only 3% of global battery storage investment from 2015 to 2024, but higher investment in Africa, India and the Middle East enlarged this share to 11% in 2025.

Regional trends for generation investment are more differentiated. In the United States, accelerating electricity demand – driven in large part by rapid growth in data centres – has contributed to a surge in gas turbine orders. Combined with rising turbine prices, this uptick led to a nearly threefold increase in gas-fired power investment in 2025. In contrast, the short-term US forecast for new solar PV and wind deployment has been revised downwards due to the phase-out of tax credits as well as uncertainties surrounding Foreign Entity of Concern rules and federal permitting procedures. Having plateaued from 2023 to 2025, low-emissions generation investment is consequently expected to decline in 2026.

In China, low-emissions generation investment also declined in 2025 – but this was largely the result of steep reductions in capital costs

for solar PV and wind rather than a deliberate pivot from renewables. That said, 2025 pricing reforms are expected to narrow profit margins and decrease revenue certainty for renewable energy developers. Although strong short-term deployment is anticipated, capacity additions are still expected to fall short of the record-breaking 484 GW of new solar and wind deployed in 2025. This is a key reason for the decline in global renewables investment expected in 2026, given the size of China's domestic market.

Outside of the world's two largest economies, the trend towards low-emissions generation is becoming more pronounced. In Europe, low-emissions investment increased 7% in 2025 primarily owing to strong growth in wind energy, which is benefitting from heightened security significance. Further growth of 4% is expected in 2026, which would bring the region's low-emissions share of generation investment to 93%. However, among the most striking developments have been seen in EMDE, where many countries have increased their share of low-emissions sources in generation to levels comparable to many advanced economies. In total, developing Asia and Africa has seen this share grow 20 percentage points from 57% in 2019 to 77% in 2025.

These shifts are now occurring against a backdrop of renewed geopolitical risk. A key theme of last year's World Energy Investment report was uncertainty, and 12 months later, with another severe disruption to global oil and gas markets, the outlook has become even less predictable and more volatile. This time, the direct consequences are most acute for Asian countries, and their responses will shape both investment trends and energy security for years to come. Europe's co-ordinated policy response and Pakistan's decentralised adaptation to the 2021-2023 energy crisis indicate the different ways fuel price spikes can spur transformational change – particularly in fuel-importing regions – when the right incentives align.

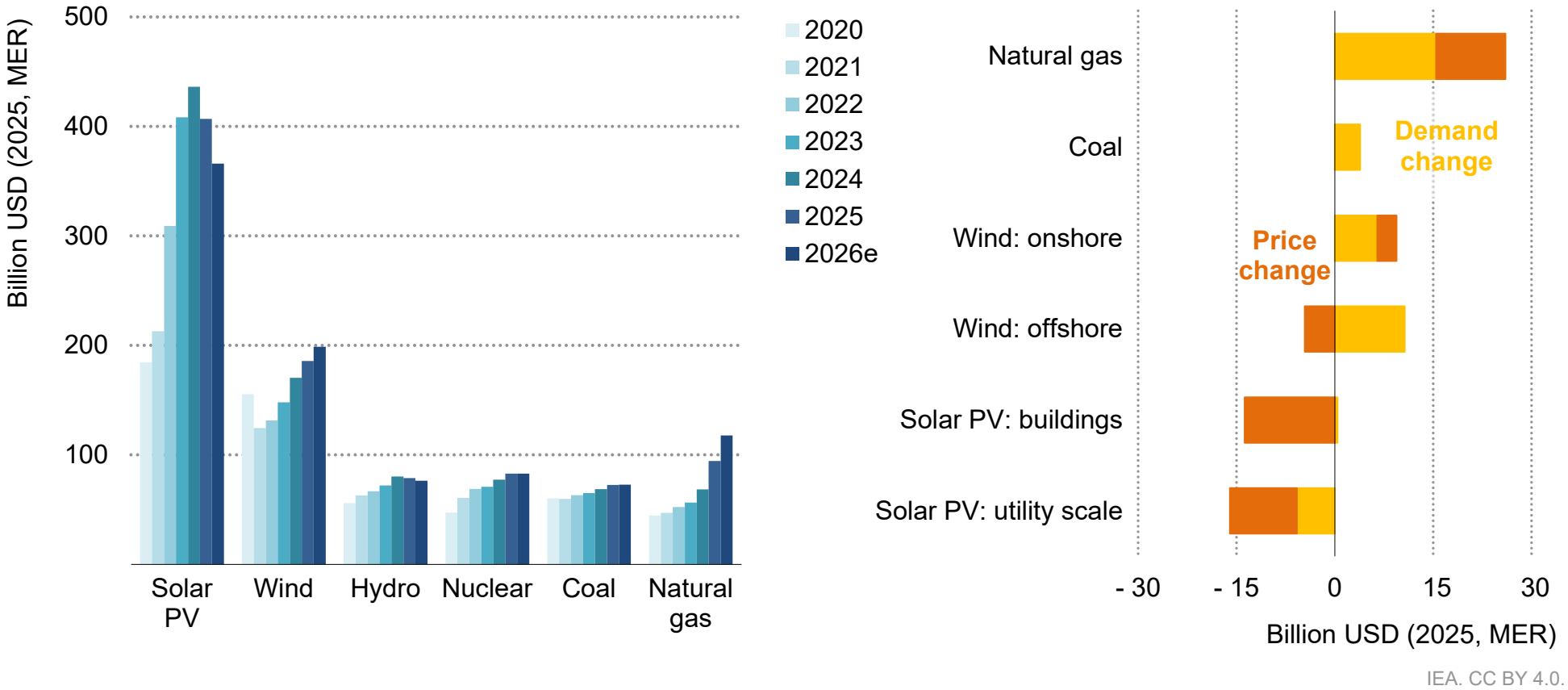
However, security considerations extend beyond fuels to the broader supply chains needed to build and operate secure power systems. Although the distinction between one-time embodied dependency (e.g. solar panels) and continuous or recurring dependency (e.g. fuel consumption) is clear, having refined critical minerals production and clean energy technology supply chains concentrated in China, with trade often flowing through potential maritime chokepoints, means renewables are also subject to their own security vulnerabilities.

While long-duration energy storage, interconnectors, and grid digitisation with demand-side response capabilities are being developed, dispatchable generation remains a key medium-term solution for many countries to meet energy demand continuously and reliably. This reinforces the need for holistic policy approaches that encompass different technologies and infrastructure investments, as well as efforts to strengthen trusted supplier networks and diversify supply chains – from inputs such as copper, natural gas and uranium to finished products such as grid components and wind turbines.

Generation

Recent changes in new generation investment reflect both price changes and evolving demand

Global investment, 2020-2026e (left), and drivers of annual investment changes, 2025 vs 2024 (right), for selected technologies

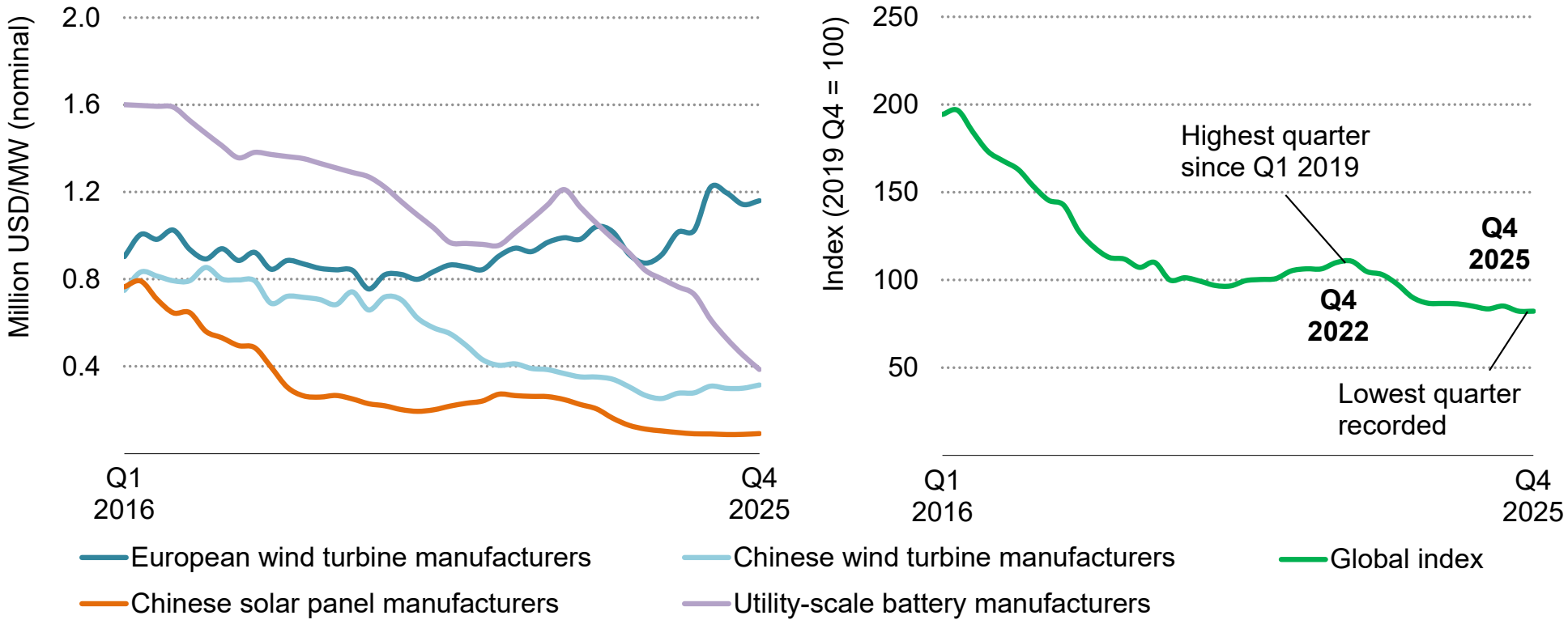


Declining capital costs were the primary reason for lower solar PV investment in 2025. For other sectors such as wind and gas power, a combination of rising equipment prices (e.g. for gas turbines) and an increase in construction starts drove investment growth.

Notes: MER = market exchange rate. 2026e = estimated. “Demand change” measures the change in investment due to an increase or decrease in the number of projects under construction, including those scheduled to become operational in future years. This means that the demand change can be negative even if capacity additions grew in that year. “Price change” measures the change in investment due to a change in equipment prices, using 2024 prices as the base year.

Plummeting battery storage costs drive further reductions in the clean energy price index

Manufacturers' average selling prices (left) and IEA clean energy equipment price index (right), Q1 2016-Q4 2025



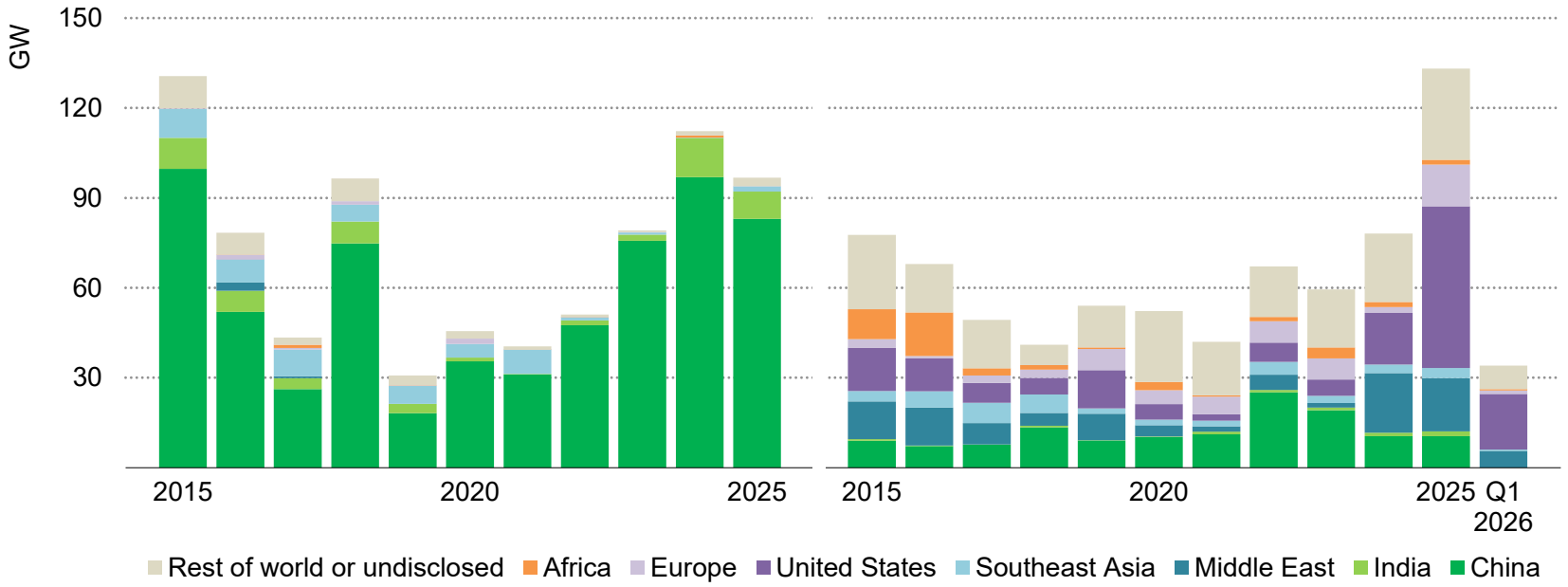
After a decade of relatively uninterrupted declines, the selling prices of solar panels and wind turbines from Chinese manufacturers have plateaued or – in the case of the latter –risen through the course of 2025. Battery storage costs meanwhile continued to fall dramatically.

Notes: BESS = battery energy storage system. The clean energy equipment price index, developed by the IEA, tracks price movements for a global assortment of solar PV modules, wind turbines, lithium-ion batteries for electric vehicles, and utility-scale battery storage, weighted by share of investment. Prices correspond to the price at point of sale, but for the power sector, it can take months or years before the equipment is installed. Prices do not include the impacts of tariffs.

Sources: IEA analysis based on companies' financial reports; BNEF (2025) Lithium-Ion Battery Price Survey; BNEF (2025) Wind Turbine Price Index 2H 2025, BNEF (2026), Solar Spot Price Index (accessed May 2026).

New coal construction starts slowed, led by China, while FIDs for natural gas generation raced past coal to reach 130 GW in 2025 – the most in 25 years and second-highest level on record

FIDs for new coal-fired generation (left) and natural gas-fired generation (right) by region, 2015-Q1 2026



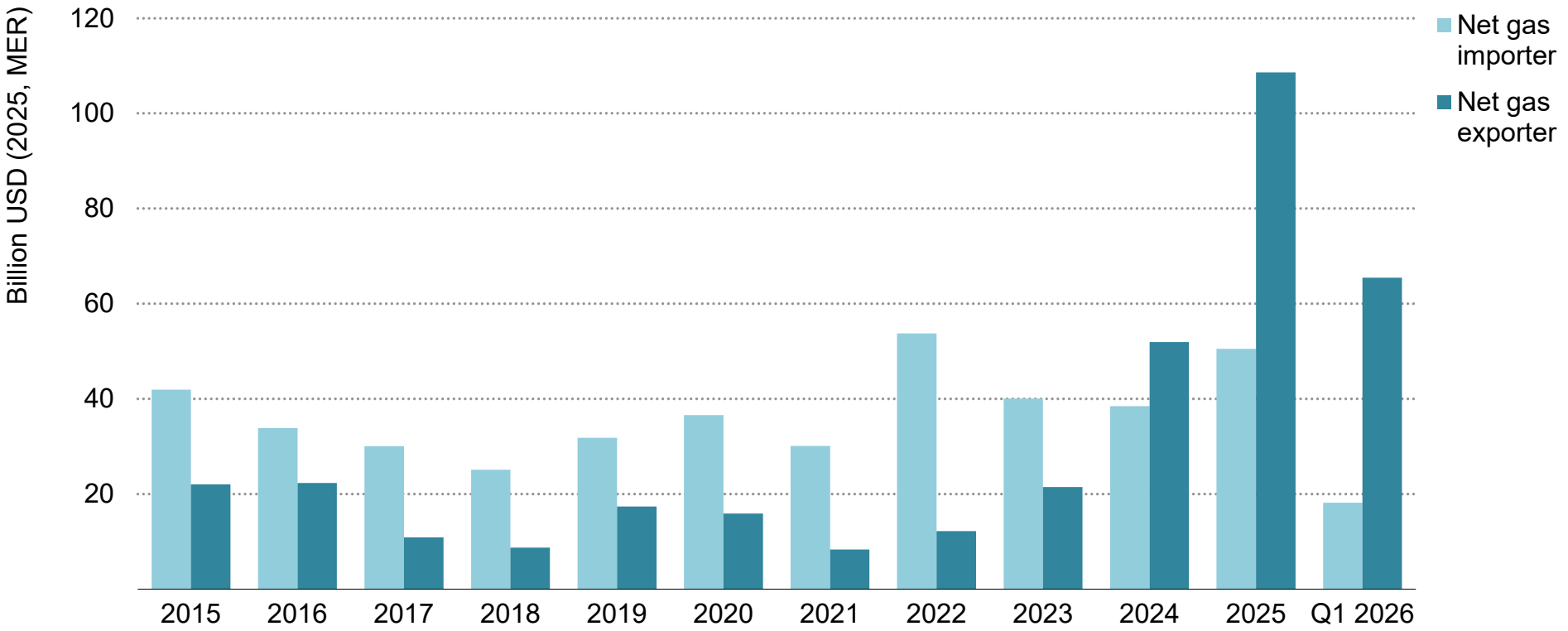
Growth in electricity demand is accelerating in many advanced economies after years of plateauing demand. In response to this abrupt change, FIDs for new gas-fired generation increased 60% from 2024 to 2025, led by the United States and Europe.

Notes: FID = final investment decision. For regional definitions, see the Methodology Annex. FIDs indicate the scale of capacity to come online in upcoming years, but the time it takes for new plants to become operational can vary. For coal power in China, FIDs are measured in construction starts. For all other regions and for natural gas generation, FIDs are measured using turbine orders. Coal- and gas-fired generation with or without CCUS is included. Gas orders cover both gas and steam turbines 10 MW or larger. Q1 data for coal not available.

Sources: IEA analysis based on McCoy (2026), Gas Turbine and Steam Turbine Order dataset; Global Energy Monitor (2026), Global Coal Plant Tracker.

The pick-up in approvals of new gas-fired power plants has been in gas-rich countries; the current conflict may well reinforce wariness among gas importers

Value of new gas generation FIDs for net gas importers vs exporters, 2015-Q1 2026



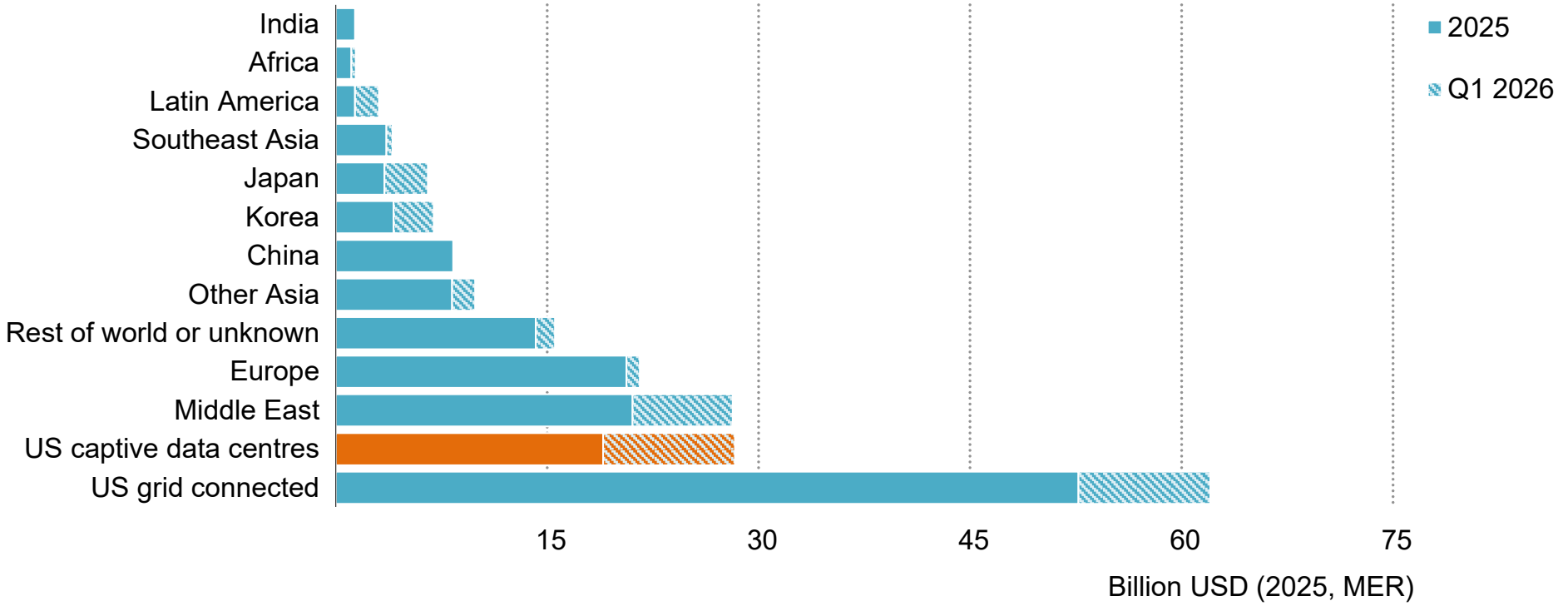
Gas importers were the primary destination of turbine orders for much of the past decade, but growth has shifted to net exporters since 2024. Declining investment is most pronounced in China, which registered zero turbine orders in Q1 of 2026 for the first time since 1998.

Notes: MER = market exchange rate. FID = final investment decision. The figure aggregates total investment spending over the construction period to the year of the project's turbine order.

Source: IEA analysis based on McCoy (2026), Gas Turbine and Steam Turbine Order dataset.

Artificial intelligence is also central to gas investment trends: if data centres were a country, they would be the second-largest destination for gas turbines ordered from Q1 2025 to Q1 2026

Value of new gas generation FIDs by country or region and use-case, Q1 2025-Q1 2026



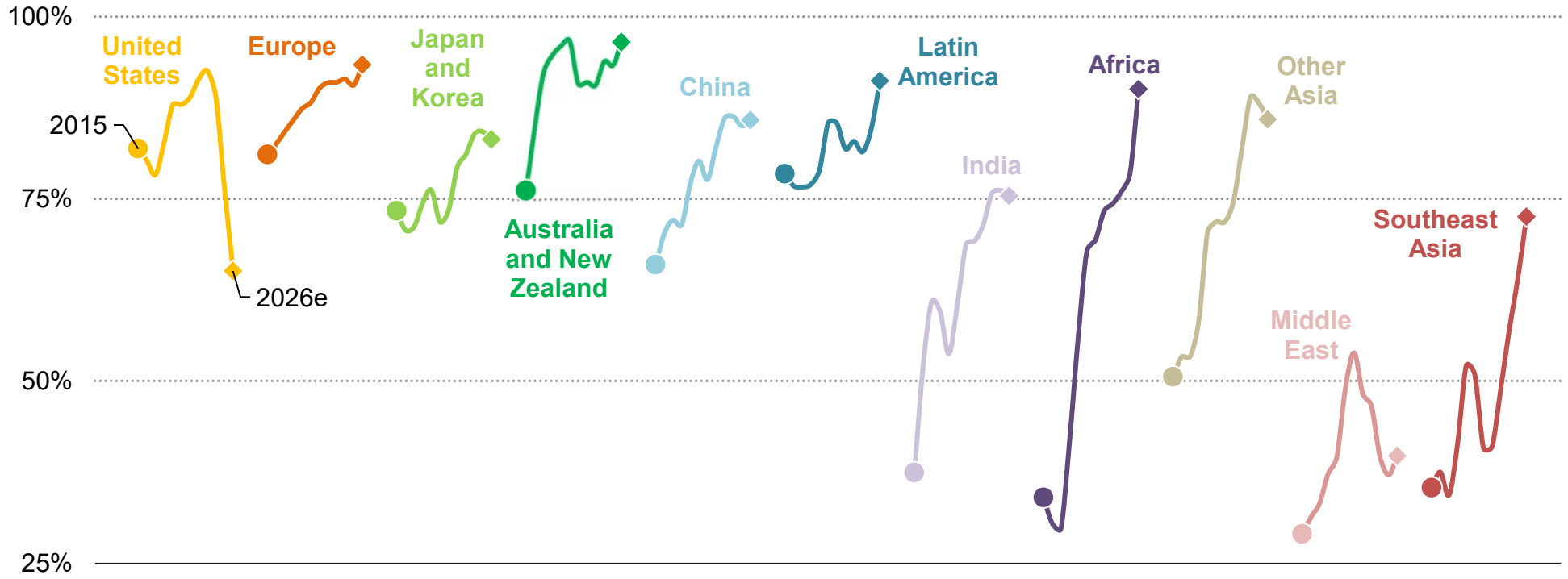
While energy security concerns may be prompting a decline in turbine orders in some gas-importing regions, the data centre boom in the United States is also a key driver of recent trends – particularly in Q1 of 2026 where captive power orders surpassed grid connected.

Notes: MER = market exchange rate. FID = final investment decision. US = United States. The graph illustrates the total value of gas turbine investments in the year (or quarter) they are ordered. Values in blue are orders for conventional grid-connected power plants.

Source: IEA analysis based on McCoy (2026), Gas Turbine and Steam Turbine Order dataset.

The low-emissions share of total electricity generation investment continues to rise in most regions, now making up 75% or more in many emerging market and developing economies

Low-emissions generation investment shares for selected regions, 2015-2026e

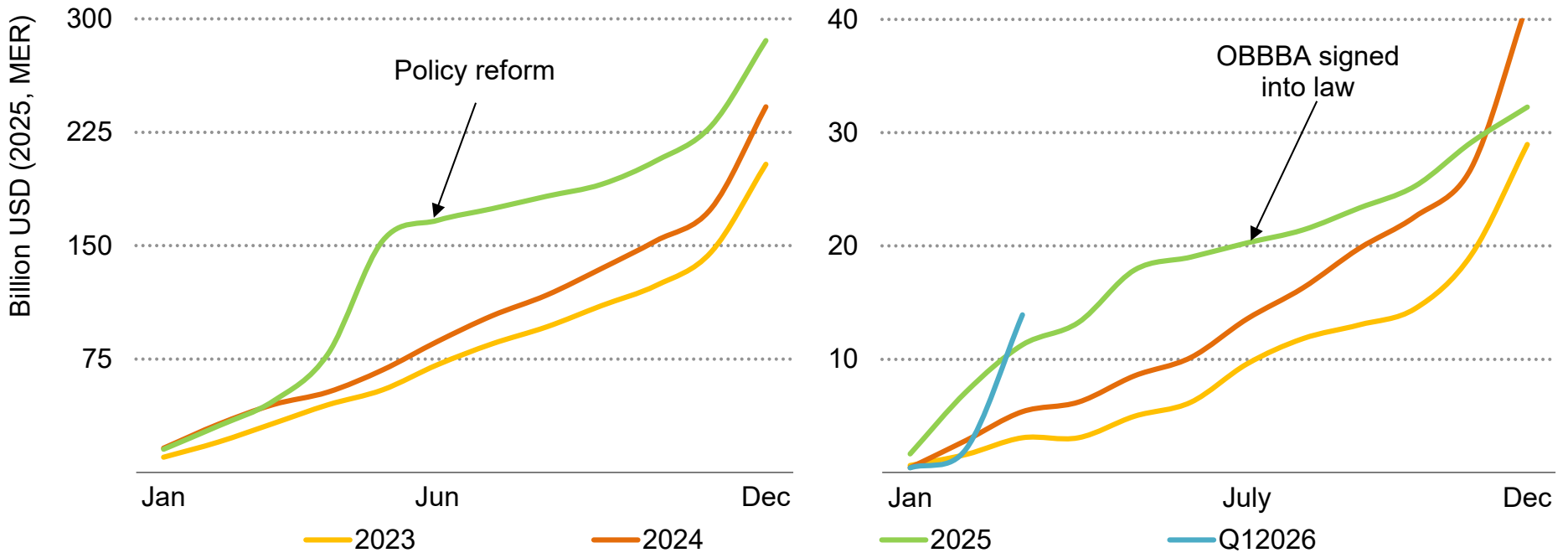


Many advanced economies have surpassed a 90% share of generation investment from low-emissions sources, but emerging market and developing economies have had the fastest change in composition of investment in recent years.

Notes: 2026e = estimated. "Low-emissions generation" refers to renewables, nuclear, renewable waste and fossil power with CCUS. For regional definitions, see the Methodology Annex.

However, following a rush to start or complete projects ahead of policy changes, China and the United States are expected to register a slowdown in solar and wind investment in 2026

Cumulative overnight investment per year in China (left) and FIDs in the United States (right) for solar PV and wind, 2023-Q1 2026e



China broke records in 2025 as developers rushed to complete solar and wind projects before reforms took force, but new pricing rules are expected to slow 2026 capacity additions. Similar behaviour was observed in the United States in Q1 2026 to beat tax credit cutoffs.

Notes: MER = market exchange rate. FID = final investment decision. OBBBA = One Big Beautiful Bill Act. Overnight investment accrues total capital expenditures over the construction period to the month that the capacity is commissioned. This is different from investment spending, the traditional measure used in this report, which is spread over the construction period of the asset. Right graph measures positive project finance FIDs but does not capture new projects financed on companies' balance sheets.

Sources: IEA analysis based on China's National Energy Administration (NEA) (2026), monthly power capacity statistics and IJGlobal (2026), Infrastructure Transaction dataset (accessed April 2026).

Investment trends are diverging as countries pursue varied paths to meet demand securely

As today's investments largely reflect decisions made in the past, the effects of changes in the investment environment often take years to fully materialise. This is important to consider in the wake of significant policy shifts in the world's two largest economies, China and the United States, as well as the broader uncertainty facing the global economy regarding the duration and severity of potential oil and gas market disruptions.

Based on recent data, our expectation is that the change in renewables policies in both China and the United States will result in less solar and wind deployment than under former policy settings. Solar and wind remain the primary destination for new investment, but, given the size of these two markets and continued downward price pressure in China, any slowdown in deployment – let alone a decline – will have a large impact on global renewables investment in upcoming years.

The magnitude of this outcome remains contingent on several unknowns. Although solar and wind capacity additions declined 28% year-on-year in the second half of 2025 following a rush to complete projects before reforms took force, China has consistently surpassed records for renewables deployment. For instance, the 117 GW of onshore wind China installed in 2025 is roughly equivalent to total European onshore wind installations from 2017 to 2025.

The unparalleled size of China's domestic market and manufacturing capacity also exposes a vulnerability. Any slowdown will exacerbate existing financial strains on domestic manufacturers who are increasingly being shut out from large export markets such as the United States and India. As investment is highly sensitive to policy changes, government intervention could offset some of the expected impacts. However, with Q1 2026 solar PV installations down 31% year-on-year, a significant short-term slowdown is more certain.

In the United States, changes to federal permitting rules and incentives are making new renewables projects riskier and less profitable than under former policies. Offshore wind development, which relies extensively on federal permitting, has ground to a halt, with new project FIDs disappearing after 2024 highs of over USD 5 billion. The current project pipeline implies robust, albeit slower, solar and wind deployment for 2026 and 2027, but development beyond this is more uncertain, given project delays and the phase-out of federal tax incentives for ventures beginning construction after 4 July 2026.

Outside of the United States and China, low-emissions generation investment continues to grow and represents 90% or more of total generation investment in many advanced economies. In Europe, for example, annual renewables investment increased 8% to USD 135 billion in 2025 and is expected to reach USD 143 billion in 2026. For solar PV, total capacity additions in advanced economies outside of the United States are expected to remain around current levels in 2026. However, because prices are declining in parallel, solar PV investment also falls in 2026. In contrast, the costs of new wind projects outside of China remain elevated. Combined with a 200-plus

GW pipeline of offshore and onshore projects expected by 2030, this is keeping overall renewables investment growth positive.

The most rapid changes in the composition of new generation investment in recent years have been in EMDE with the share from low-emissions sources now accounting for more than three-quarters in all regions except the Middle East, Southeast Asia and Eurasia. In 2025, annual investment grew 29% in Southeast Asia, 22% in the Middle East, 16% in India and 3% in Africa, supported by renewed renewables targets, more regular auctions, new public incentives and, in some cases, an improved macroeconomic backdrop. In much of developing Asia and Africa, the share of investment in low-emissions generation sources is comparable to some advanced economies, although absolute investment is comparably much smaller.

Another notable development for investment is the return of electricity demand growth in many advanced economies after a 15-year period of flat or declining demand. In the European Union, an additional 300 TWh of electricity demand by 2030 is forecast as the result of fairly broad-based growth from electric vehicles, heat pumps, cooling, industry and some data centres. Electricity demand is expected to pick up in the United States as well – an average of 2% per year from 2026 to 2030 – with data centres contributing half of the cumulative increase.

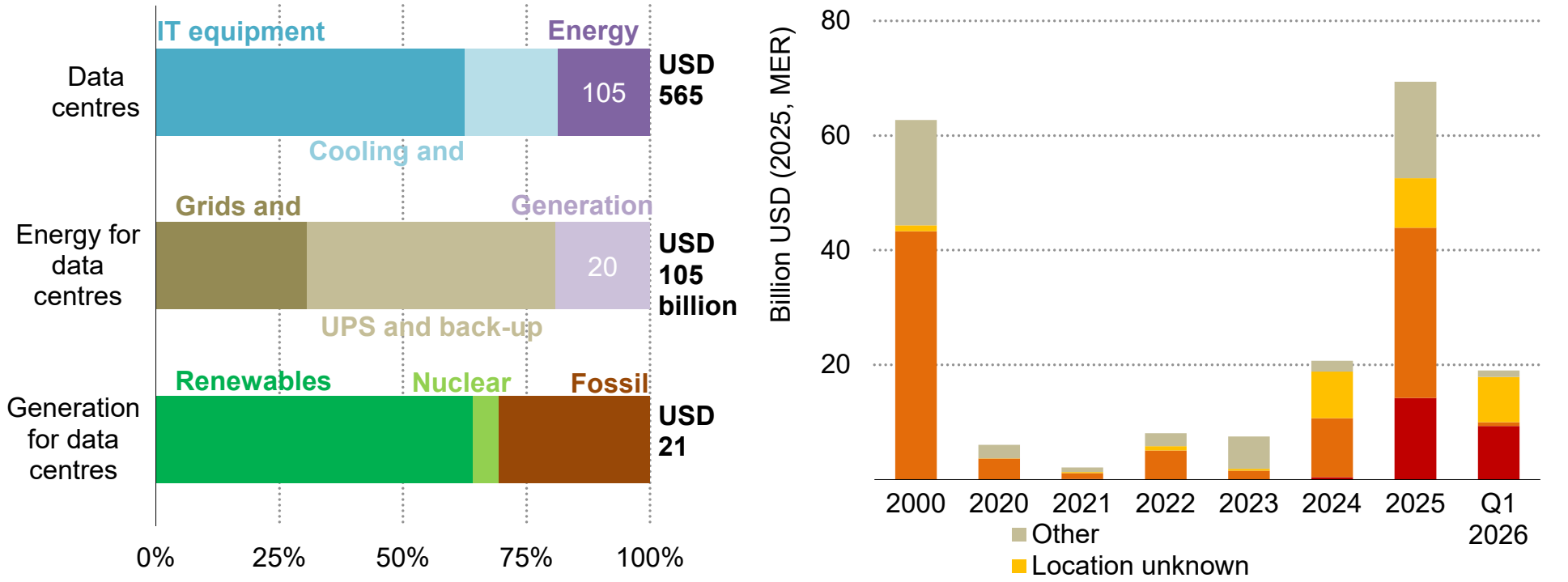
The rapid growth in large, high-uptime demand sources is creating adequacy challenges in locations where data centres are clustered, while rising shares of wind and solar increase the need for power system flexibility to balance supply variability. Batteries have emerged as a key solution, but the most striking increase has been in natural gas generation. After increasing nearly threefold to USD 32 billion year-on-year in 2025, annual investment is expected to grow a further 66% in 2026 to over USD 50 billion in the United States. Recent turbine orders indicate that a growing share of gas-fired generation investment will be driven by captive power for data centres: USD 24 billion worth of FIDs over the past five-quarters are linked to data centre customers in the United States – with the locations of an additional USD 4 billion remaining unknown.

Meanwhile, the conflict in the Middle East could have long-term implications for the power sector. As Europe demonstrated during the 2021-23 global energy crisis, such shocks can give additional urgency to investments in strategic sectors. There are some first indications of this occurring where the impacts of the current crisis are most acute. For example, Indonesia is accelerating its diesel-to-solar generation conversion programme; in Viet Nam, a developer has requested to swap a planned 4.3-GW LNG power plant for a solar, wind and BESS installation; Thailand's emergency decree allocates half of the USD 12.2 billion in new support measures to accelerate the energy transition; the French government has pledged to nearly double public support for electrification to EUR 10 billion per year to 2030.

Pakistan's solar deployment boom, which has continued into 2026, was a result of consumers taking control of their energy destiny when faced with unpredictable and expensive supply from the centralised grid. LNG-fired generation in the country for the 2025 financial year was 40% lower than in 2022. This example showcases how rapidly a shift can occur when economic and energy security incentives align.

Data centre investment globally has surpassed oil supply investments, with the energy sector accounting for about 20% of this buildout-associated investment

Global data centre and energy investments, 2025 (left) and gas turbine FIDs in the United States, 2000-2025 (right)



An analysis of gas turbine orders reveals an AI-driven push to build new natural gas-fired power plants in the United States – the world's largest data centre market. However, data centre hotspot states as of 2025 have also accounted for high shares of orders historically.

Notes: MER = market exchange rate; IT = information technology. BESS = battery energy storage system. UPS = uninterruptable power supply.
Source: IEA analysis based on McCoy (2026), Gas Turbine and Steam Turbine Order dataset.

As the AI industry seeks energy for its operations, data centres emerge as the leading driver for natural gas turbine orders in the United States, taking gas turbine FIDs to new heights

Investment spending on IT and other data centre equipment, and on energy for data centres, amounted to USD 565 billion in 2025, a 17% rise from 2024. The rush to build new data centres has been contributing to a surge in grid connection requests. For example, the grid operator in Texas has received 180 GW of connection requests from data centres, which is two times the world's current colocation and hyperscale data centre capacity – although some requests are speculative and therefore will not come online.

For 2025, energy sector investment for the buildout of data centre infrastructure globally is estimated at USD 105 billion. This total includes grid upgrades, power equipment and generation (both grid-connected and onsite). As data centres are being built more quickly than the grid-connected generation facilities needed to service their demand, data centre operators are pushing for onsite generation solutions as a "bridge to power" as they await grid connection.

The United States – the world's largest data centre market and an exporter of natural gas – had the largest growth in orders for natural gas turbines in 2025. The value of orders for onsite generation for data centres grew to nearly USD 14 billion and accounted for 21% of turbine orders in 2025. Q1 data in 2026 shows a continuation of this momentum. These systems will be installed over the next few years and reflected in future annual investment data.

The share of gas turbine orders for grid-connected power generation projects in states that are data centre hotspots today stands at 43%. This hotspot group includes states that have most of the world's data centre capacity today, as well as those in which capacity is anticipated to grow rapidly. These states have registered a significant share of new indeterminate-location gas turbine FIDs, some of which can be attributed to data centres as technology companies shield locational information in this competitive industry.

States that are data centre hotspots as of 2025 have also accounted for a vast majority of gas turbine orders in the past – prior to the AI-driven data centre boom. Policy support for natural gas-fired power generation as well as broad-based growth in electricity consumption contribute to the investment sentiment regarding this key technology.

Several projects and approaches to power data centres have been announced recently, including Google's acquisition of Intersect Power, which operates solar and battery projects. Meanwhile, Mainspring Energy raised USD 258 million for flexible onsite generation and VEIR secured USD 75 million to improve power conversion efficiency at data centres. Finally, Microsoft, Chevron and Engine No. 1 entered into an agreement for natural gas-fired power to be supplied to data centres – additional to its 2025 partnership for gas-based generation with carbon capture and renewables.

Strong momentum for nuclear continues as investment surpasses USD 80 billion in 2025

Like in 2025, nuclear power investment is set to remain above USD 80 billion in 2026, mainly funding new builds as a wave of maintenance and refurbishment spending in Europe winds down.

Underpinned by expectations of rising demand from data centres and artificial intelligence, tech companies in the United States have made numerous announcements to develop nuclear energy. All announcements involving tech or data centre companies amount to over 50 GW of new nuclear capacity. However, the regulatory readiness of the proposed reactor designs varies, and only one US company has received US Nuclear Regulatory Commission approval for its small modular reactor (SMR) designs. Given the paucity of design approvals as well as the non-binding nature of many agreements, this project pipeline remains speculative, underscoring the importance of public support. The US government has agreed with Westinghouse and Brookfield to arrange financing and permits for USD 80 billion worth of nuclear reactors, and two companies have received USD 400 million in federal funding for SMRs.

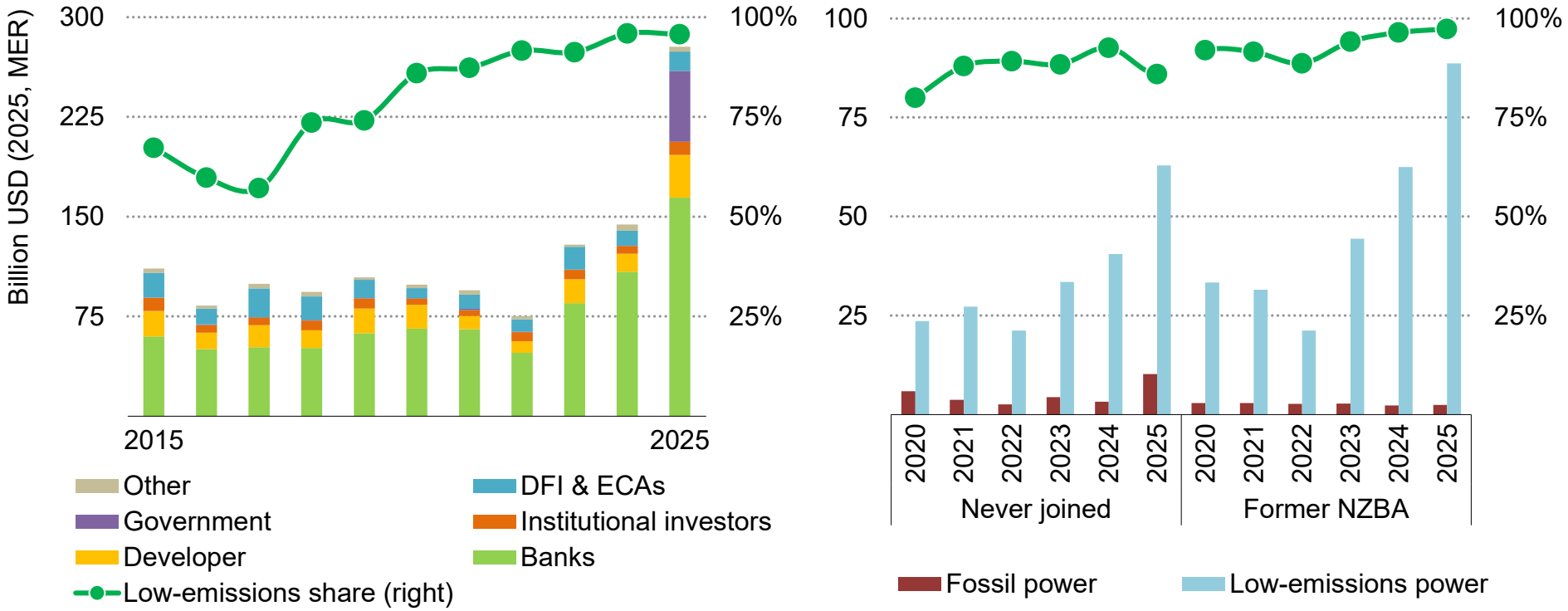
In its latest Nuclear Illustrative Programme, the European Commission estimated that nuclear energy will require a cumulative investment of EUR 241 billion to 2050 for large new builds and refurbishment and has announced a EUR 200 million guarantee fund to support private sector investment in SMR development. In the United Kingdom, Great British Energy signed a contract with Rolls-Royce SMR to develop the country's first SMR with GBP 600 million in financing from the National Wealth Fund. Still, while momentum is growing, project timelines and delivery risks remain material, particularly for new-build programmes and first-of-a-kind SMRs.

France continues to advance plans for build six new EPR2 reactors at an estimated capital expenditures (capex) of EUR 73 billion (in 2020 euros), and it is negotiating with the European Commission the details of the state aid to be provided to EDF. To accelerate private sector investment in international nuclear projects, EDF also launched an advisory board with some of the world's largest banks.

Meanwhile, China accounts for one-third of global annual nuclear investment as it continues to approve roughly 10 new builds per year. Its 15th Five-Year Plan includes the objective of 110 GW of installed capacity by 2030, as well as plans to start exporting nuclear technologies. Japan continues to re-embrace nuclear energy and reactor restarts, and the government is also considering allowing public funds to support nuclear power. Furthermore, nuclear energy is receiving more attention in new markets. In 2025, both the World Bank Group and the Asian Development Bank, which previously imposed financing restrictions for nuclear energy, adjusted their stance and have taken steps towards supporting client countries considering nuclear systems, including by signing memorandums of understanding (MOUs) with the International Atomic Energy Agency.

Clean power project financing reaches new highs among banks and institutional investors

Generation and battery storage project financing commitments by financier type (left), and for banks by NZBA status (right), 2020-2025



The share of low-emissions sources in new electricity generation project financing held steady at 96% in 2025 as the value of signed financing agreements increased 51% for banks and 67% for institutional investors.

Notes: MER = market exchange rate. DFI = development finance institution. ECA = export credit agency. NZBA = Net-Zero Banking Alliance. “Institutional investors” are asset managers, pension funds, insurers, private equity and venture capital. Graphs include primary financing and portfolio financing for greenfield assets. “Banks” refers to state-run, commercial and investment banks. The increase in government financing commitments in 2025 results primarily from UK National Wealth Fund financing of the Sizewell Site C nuclear plant.

Source: IEA analysis based on IJGlobal (2026), Infrastructure Transaction dataset (accessed April 2026).

Despite a perceived retreat from climate ambitions, financing trends paint a nuanced picture

A widely discussed theme of 2025 was the private sector's apparent backpedalling on climate ambitions, illustrated by the departures of leading global financial institutions from initiatives such as the Net-Zero Banking Alliance (NZBA), which ultimately disbanded under the threat of legal action. This turnaround, together with a policy shift in some advanced economies, created a pessimistic outlook for renewable energy companies at the beginning of 2025.

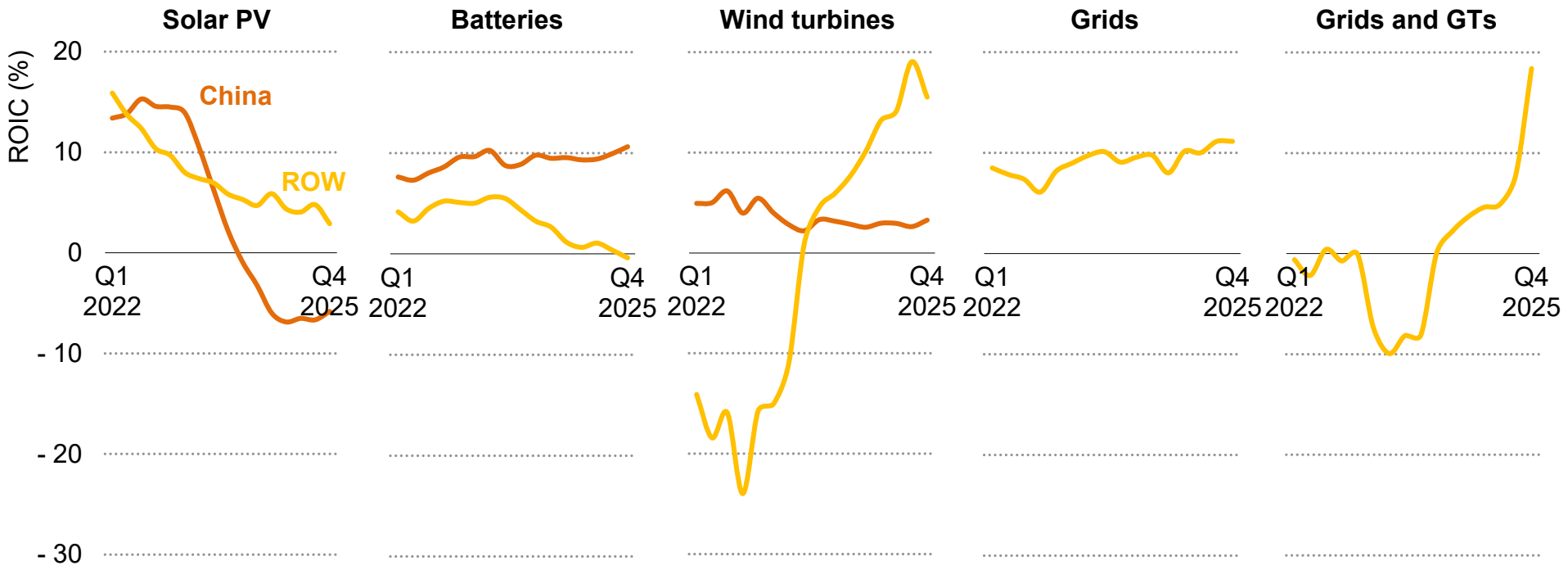
While this summary may capture the mood at the time, new data indicates a more nuanced situation. First, financing trends do not provide much evidence that renewable energy projects became any less bankable in 2025, or that commercial financing institutions changed their positions on renewables. Although our analysis focuses on project finance, which is mostly absent in China and excludes corporate bonds and direct corporate lending, primary project financing for low-emissions power rose 51% among banks and 67% among institutional investors in 2025. If this segment can be taken as a barometer of the wider market, it shows that financing is still backed by solid demand in advanced economies.

Second, probing deeper into bank funding, financing for renewable energy projects increased at a similar pace in 2025 irrespective of whether the organisation was ever an NZBA member. This provides further evidence supporting last year's World Energy Investment – namely, that renewables lending is driven by returns and cashflows – underpinned by supportive policies – and that most banks continue to underwrite what they see as a clear strategic growth opportunity. This is consistent with recent surveys of financial institutions, which revealed a large share of respondents either maintaining or growing their position on sustainable financing – and only a negligible share exiting the market. US data for the second half of 2026 will be crucial to evaluate the resilience of solar and wind projects, given the heightened risks and removal of fiscal support.

Positions on fossil power, however, may be shifting due to the data centre build out. In the past decade, China accounted for a growing share of fossil power investment, limiting opportunities for Western financiers outside of the Middle East; however, with natural gas-fired power investment now on the rise, signs of divergent financing patterns are emerging between the two groups of banks. Whereas new financial commitments for fossil power among former NZBA members has been flat since 2020, there was a more than threefold increase in 2025 among banks that had never joined. Their share of bank financing directed to low-emissions projects fell 7 percentage points in 2025 to 86%, while for former NZBA banks this figure rose to 97%. Still, this is likely not a complete picture given the substantial volumes of balance sheet debt being used to finance gas-fired projects among utilities and, increasingly, non-energy companies, for which many banks and institutional investors are playing a large role.

While returns for companies exposed to Chinese competition have fallen, electrification is still creating investment opportunities for sectors aligned with strategic interests

Weighted return on invested capital (ROIC) by sector, Q1 2022-Q4 2025



While overcapacity continues to pose challenges for solar manufacturers, other key players within the electrification value chain are benefitting from the tailwinds of accelerated energy security priorities and the strategic importance of energy for artificial intelligence.

Notes: ROW = rest of world. GT = gas turbine. “Grids” refers to pure-play grid equipment manufacturers. “Grids and GTs” represents mixed grid equipment and gas turbine manufacturers, including Siemens Energy, GE Vernova and Mitsubishi Heavy Industries. ROIC is reported at the company level and weighted by revenues for each financial quarter.

Source: IEA analysis based on data from Bloomberg (2026) terminal data.

Artificial intelligence and energy security are creating an uplift for many companies

A more considered view of the present moment is that electrification is happening at a varied pace, but the drivers and decisions for meeting new demand securely, including through prioritising domestic manufacturers, have bifurcated geographically. Consequently, some companies in the electrification value chain continue to struggle, but many others are prospering from strategic alignment with sovereign interests.

The financial struggles of solar manufacturers have continued into 2025. Returns on investment (ROIs) among selected Chinese solar PV manufacturers remained negative in 2025, and fell 3 percentage points in the rest of the world in 2025 as global oversupply continues. However, Chinese firms or other companies in direct competition with them are not a reliable barometer of financial health, as state support and production targets allow these companies to sustain negative margins in ways that Western companies cannot. Without subsidies, the average levelised production cost of Chinese modules was considerably higher than average selling prices observed in 2025.

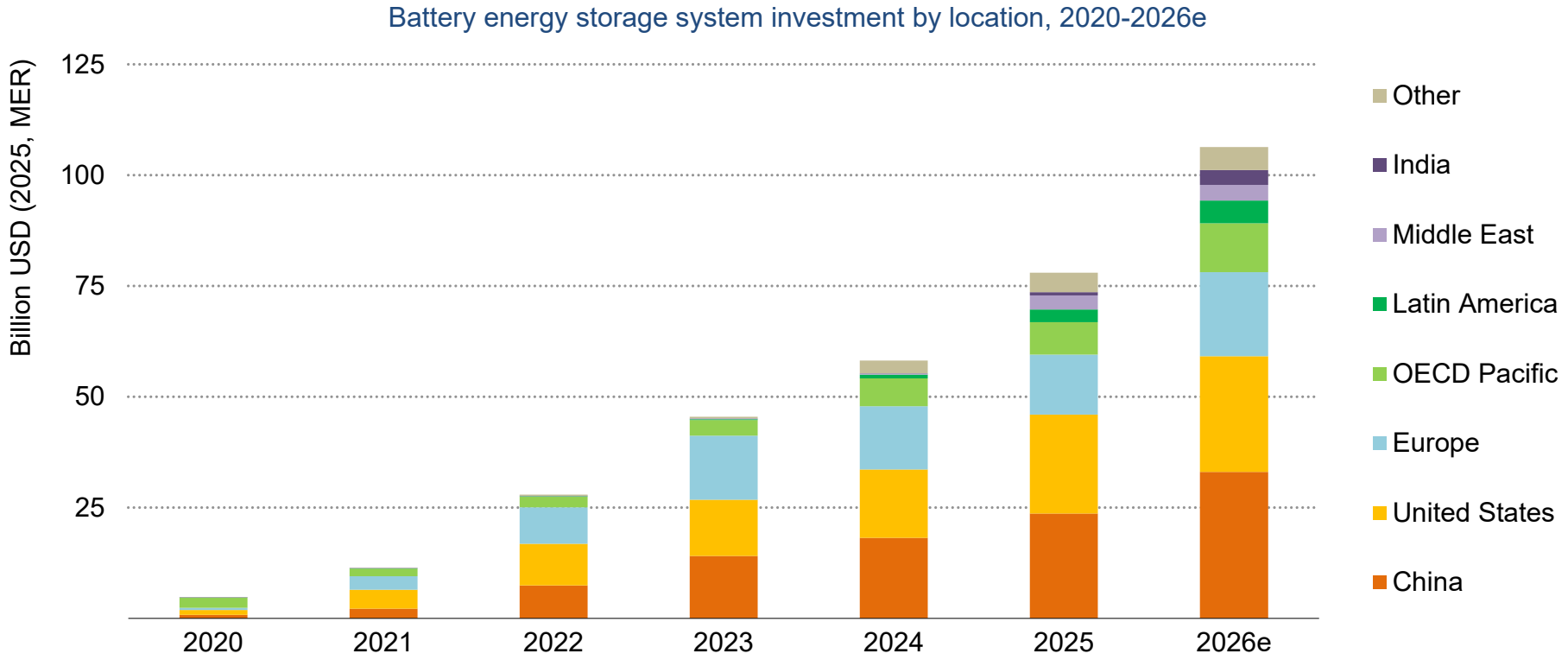
Batteries and wind turbines show regional divergence. Chinese battery manufacturers continue to post impressive returns, with ROI rising to 11% in Q4 2025, whereas manufacturers in the rest of the world are struggling to compete on costs and innovation. For wind, the ROI of Western turbine manufacturers increased from 10% in Q4 of 2024 to 16% in Q4 of 2025 as companies executed their strategic resets and European countries continued to favour domestic- to Chinese-made turbines. Indeed, EBITDA margins have fully recovered from 2022 lows for Europe's two largest manufacturers, Vestas (+15 percentage points) and Nordex (+12 points). In 2025, the combined weighted valuation for all listed non-Chinese turbine manufacturers rose 73% despite new setbacks in the US market.

The data centre boom and strategic prioritisation of artificial intelligence (AI) is a major driver of improved performance in the gas services segments of major turbine manufacturers. The ROI of these companies climbed 15 percentage points in 2025, with the net income margins of the two largest manufacturers by output (Siemens Energy and GE Vernova) achieving a combined order book of USD 169 billion in the first quarter of 2026.

Downstream of generation, the direction of travel is more uniform: manufacturers of transformers, switchgears, cables, high-voltage direct current systems and other grid equipment have been largely insulated from the policy shifts and changing market conditions in recent years. Instead, their ROI has been mostly steady since 2022, reaching 11% in Q4 2025 as equipment demand continued to outpace supply, leading to rising prices and order backlogs. While there is likely an AI and domestic (cyber) security component to the financial improvement in this case as well, this upturn signals that the electrification push has not lost momentum.

Battery storage

Battery energy storage investment is expected to surpass USD 100 billion in 2026e as new capacity additions continue to outpace price declines



Global investment in battery energy storage is set to grow by over 35% in 2026 – led by China, the United States and Australia – in line with rising needs to facilitate renewable energy integration and maintain system flexibility.

Notes: MER = market exchange rate. BESS = battery energy storage system. 2026e = estimated. For regional definitions, see the Methodology Annex. Spending includes turnkey components, engineering, procurement, construction, developer margins and overhead.

Sources: IEA analysis based on Bloomberg (2025), Lithium-Ion Battery Price Survey and Benchmark (2026), Mineral Intelligence dataset (accessed April 2026).

Policies continue to support increasingly cost-competitive battery energy storage technologies, and EMDE investments outside of China nearly triple

Investment in battery energy storage systems (BESS) maintained a strong growth trajectory in 2025, with total spending growing over 30% year-on-year to nearly USD 80 billion. Utility-scale applications account for a progressively larger share of investment than behind-the-meter (BTM) technologies, nearly 65% of total spending in 2025. Standalone installations remain the primary driver of utility-scale BESS deployment, with investment growing by USD 11 billion from 2024 to 2025.

As a share of total power sector spending, BESS investment is broadly growing alongside wind and solar power penetration, signalling that energy storage is increasingly recognised as an important enabler of variable renewable energy (VRE) integration as flexibility needs rise. In 2025, countries and regions with VRE penetration rates exceeding 20% allocated 5% of their power sector spending on average to BESS, while BESS accounted for only 3% of power sector investment when penetration rates were below 10%. Aside from supporting VRE resources, BESS are an important provider of congestion management and ancillary services in countries where rising electricity demand necessitates additional system flexibility.

In the United States, preservation of the Section 48E tax credit for energy storage projects under the One Big Beautiful Bill Act (OBBBA) facilitates continued BESS investment. However, the OBBBA also tightens Foreign Entity of Concern rules for battery components, while tariffs on non-EV batteries imported from China reached 155% in 2025. US developers are increasingly turning to Korean manufacturers to meet domestic demand, with LG Energy Solutions signing a USD 4.3 billion deal to supply Tesla with storage systems. Additionally, a number of battery manufacturing facilities in the United States are shifting production of EV batteries for BESS in response to a more uncertain policy environment and demand outlook.

In China, lifting of the requirement for solar and wind projects to pair with energy storage means that BESS assets will increasingly depend on participation in electricity markets for remuneration. However, streamlined grid connection for standalone projects propelled total Chinese investment to USD 24 billion in 2025. China continues to dominate the global BESS supply chain, with manufacturing capacity representing almost twice global deployment. A surplus of manufacturing capacity and intense competition among domestic suppliers drove average global capital costs down nearly 14% relative to 2024, but government measures to mitigate the effects of competition could slow price declines in 2026.

Several new countries entered battery energy storage markets in 2025, notably in the Middle East. Driven by Saudi Arabia, BESS investment in the region rose to USD 3 billion in 2025 to support the

installation of over 10 GWh of stationary storage. Propelled by government targets for VRE and BESS deployment, the country's state-owned utility achieved rapid buildout through streamlined permitting processes and the use of pre-assembled BESS containers provided by the Chinese equipment manufacturer Sungrow.

Meanwhile, India's BESS investments reached USD 700 million in 2025 as projects also increased in scale. Driven by the need to avoid curtailment of the country's rapidly growing VRE generation, tender volumes for standalone and co-located projects nearly tripled from 2024. Government support through a renewed viability-gap funding scheme has paved the way for individual projects to scale from relatively small pilot-size systems to multi-GWh installations.

In Pakistan, the number of BTM installations has grown quickly in recent years, with the country importing 400 MWh in the first two months of 2025 alone. However, this rapid expansion heightens the need for updated regulation and grid modernisation to ensure that distributed storage is integrated into national system planning without jeopardising network stability or the financial health of utilities.

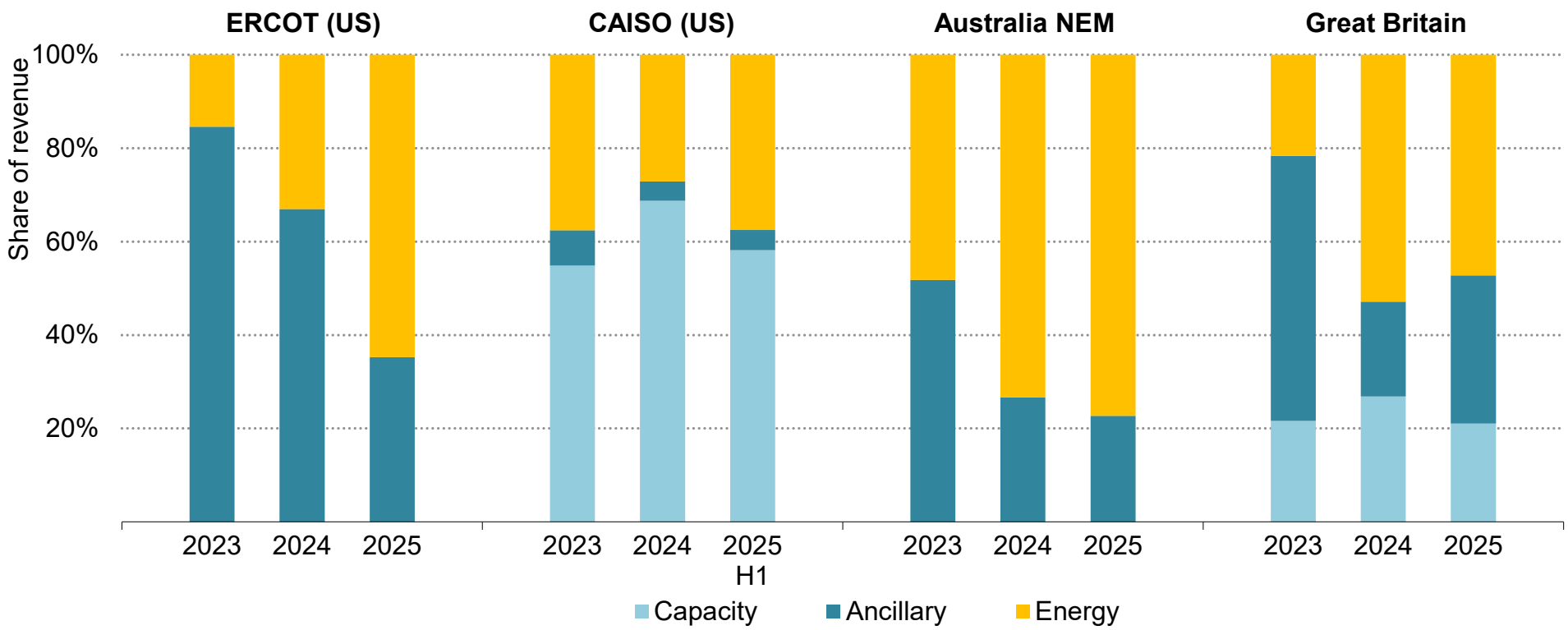
While lithium-iron-phosphate (LFP) technologies are currently used in over 90% of global BESS capacity, the growing need for multi-day and even seasonal flexibility has encouraged the development of technologies suited to long-duration energy storage (LDES). China launched operations at the world's first utility-scale vanadium redox flow battery facility in early 2026, and start-ups developing LDES chemistries in Singapore, Korea and the United States are expected to scale up investments in manufacturing capacity this year. The world's largest compressed air energy storage (CAES) facility also began operations in China in the first half of 2026, with another utility-scale project set to begin construction in the United States.

BESS installations are also being increasingly recognised as important contributors to energy security, especially in the wake of the ongoing Middle East crisis. For instance, BESS can decouple electricity prices from natural gas by storing energy during periods of surplus solar PV and wind production – when prices are lower – and discharging it during peak-demand hours. While wider arbitrage opportunities will attract project developers, mounting energy security and affordability concerns amid fuel price volatility are likely to encourage governments to accelerate the deployment of both standalone and co-located energy storage capacity.

Meanwhile, battery storage equipment manufacturers are already anticipating an increase in profits in the first quarter of 2026. Chinese equipment supplier Ningbo Deye Technology Co., which manufactures turnkey storage systems and inverters used in BESS, has attributed an expected rise in profits to increased electricity price volatility and a renewed focus on energy security among governments. CATL, the world's largest manufacturer of lithium-ion batteries, saw year-on-year net profit grow by nearly 50% in the first quarter of 2026 and is expanding its production capacity for energy storage technologies.

Energy arbitrage accounts for the largest single source of market-based revenue for utility-scale battery assets in systems with high BESS capacity

Share of market-based revenue by service for selected networks, 2023-2025



BESS assets in the United States, Australia and Great Britain earned 55% of their revenues from energy-based payments in 2025.

Notes: ERCOT = Electric Reliability Council of Texas. CAISO = California Independent System Operator. NEM = National Electricity Market. BESS assets are remunerated by: (1) energy markets, based on the MWh of electricity they inject into or consume from the grid; (2) capacity markets, based on their availability to respond to peak demand events; and (3) ancillary markets, based on the provision of grid stability and reliability services.

Source: IEA analysis based on Modo Energy (2026), BESS revenues datasets.

Growing capacity for ancillary services is putting downward pressure on traditional BESS revenue streams in established markets, but developers and financiers are adapting rapidly

Continued evolution in revenue streams and business models accompanied utility-scale BESS capacity growth in several advanced economies in 2025. Lower margins in ancillary and capacity markets due to a rising number of participants – in addition to more frequent low and negative prices as more VRE sources come online – has led new assets to rely on energy price arbitrage for a growing share of their revenues.

In Texas' ERCOT, BESS assets cumulatively earned 65% of their revenues from day-ahead and real-time energy markets in 2025, nearly double the share in 2024. However, total annual revenues also fell 50% year-on-year in 2025, suggesting that increased competition in ERCOT is a growing threat to bankability for the nearly 14 GW of BESS capacity expected to come online in 2026.

New business models have been developed to create additional revenue streams and accommodate the emergence of new offtakers. The procurement of firmed power purchase agreements (PPAs), which combine solar PV or wind generation with BESS to provide a more stable source of electricity, is particularly valuable for corporate customers and data centres prioritising decarbonised electricity.

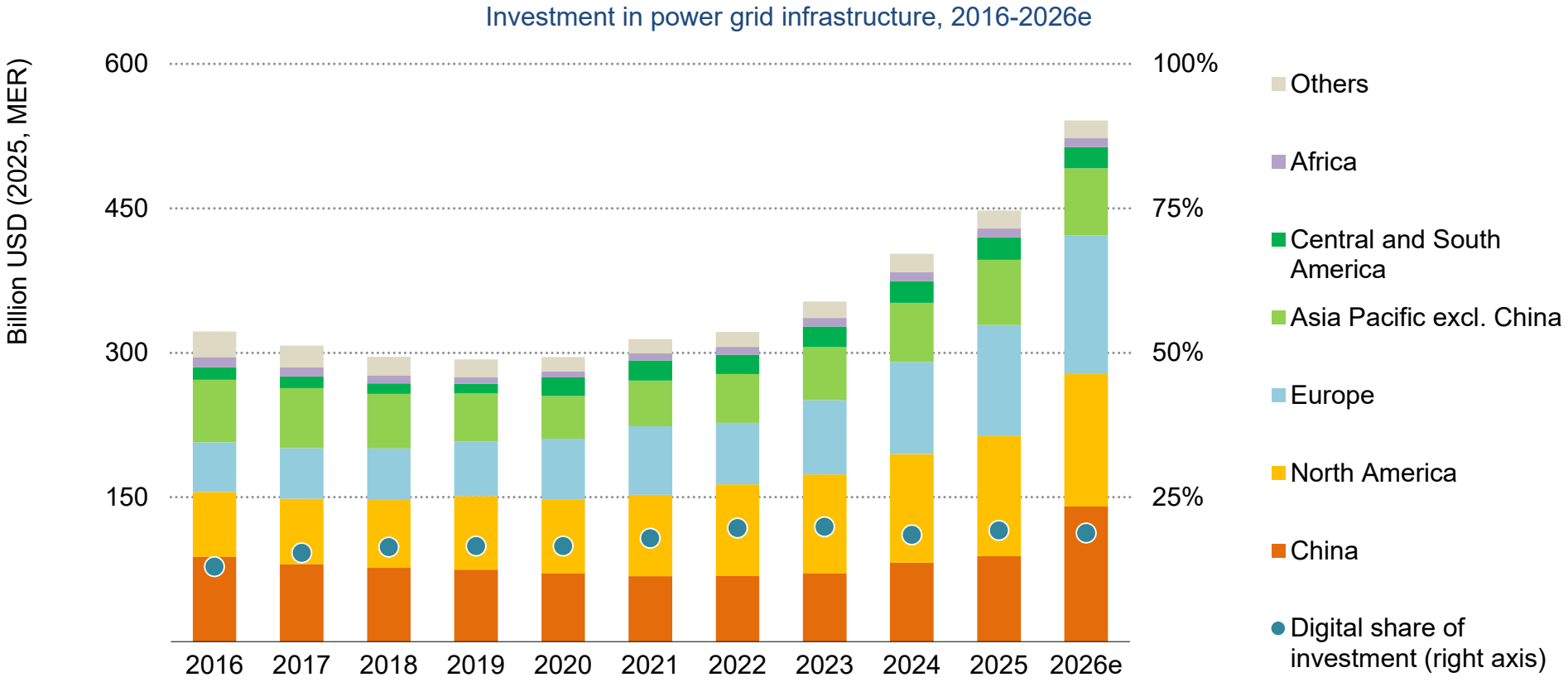
Meanwhile, more flexible warranty frameworks can regularly adapt their performance thresholds to the actual usage of BESS assets, rather than constraining them to narrow operational standards. This in turn allows BESS operators to dispatch their systems with greater flexibility, facilitating “revenue stacking” in a combination of energy, capacity and ancillary service markets. Finally, BESS-as-a-service models for behind-the-meter storage allow customers to repay capital expenses through fixed service payments, removing barriers imposed by high upfront costs.

As BESS attract new types of offtakers, new investors and financiers are also entering the market. The creation of storage-oriented investment portfolios and the widening role of institutional investors (e.g. pension and sovereign wealth funds) provide new sources of capital. For instance, the UK National Wealth Fund joined forces with Australian pension fund Aware Super to mobilise USD 672 million (GBP 500 million) in equity in 2025 to support nearly 1 GW of storage projects across England and Scotland.

2025 saw BESS capacity grow among countries with varying degrees of market liberalisation, where energy arbitrage opportunities may be limited. In such markets, BESS assets are typically remunerated based on capacity and availability, which boosts project bankability by creating predictable cash flows. For example, Malawi’s state-owned utility ESCOM will remunerate the country’s first BESS installation through a combination of EPC and O&M contracts.

Grids

Electricity grid investments have accelerated in recent years, rising 11% in 2025



Power grid investments gained momentum in recent years after a period of stagnation relative to generation. Europe, the United States and China are leading the rebound, accounting for more than two-thirds of global investment growth from 2023 to 2025.

Notes: MER = market exchange rate. 2026e = estimated. For regional definitions, see the Methodology Annex.

Source: IEA analysis based on financial statements of transmission and distribution companies; S&P (2026), Capital IQ data; and Global Transmission (2025), data.

Although grid investment is poised for double-digit growth in 2026, driven by higher equipment prices and expanding system needs, it remains below requirements

Following a prolonged period of stagnation, global grid investment has accelerated in recent years. Total spending rose USD 45 billion in 2025 to nearly USD 450 billion – the largest increase across the power system – and is projected to grow a further 17% in 2026.

However, this upswing partly reflects inflationary pressures on grid equipment – including transformers, cables and even overhead lines – rather than just higher volumes of delivered infrastructure. These cost pressures stem from several factors, including rising project complexity, shortages of skilled labour, the pass-through of higher input costs (notably for grain-oriented electrical steel, copper and aluminium), and insufficient manufacturing capacity in many parts of this highly specialised supply chain. Consequently, utilities are increasingly relying on framework agreements that secure supplies over longer horizons for planned investment programmes, instead of contracting on a project-by-project basis. Manufacturers are also investing to expand capacity, with capital expenditures in the first three-quarters of 2025 being 12% higher than in 2024.

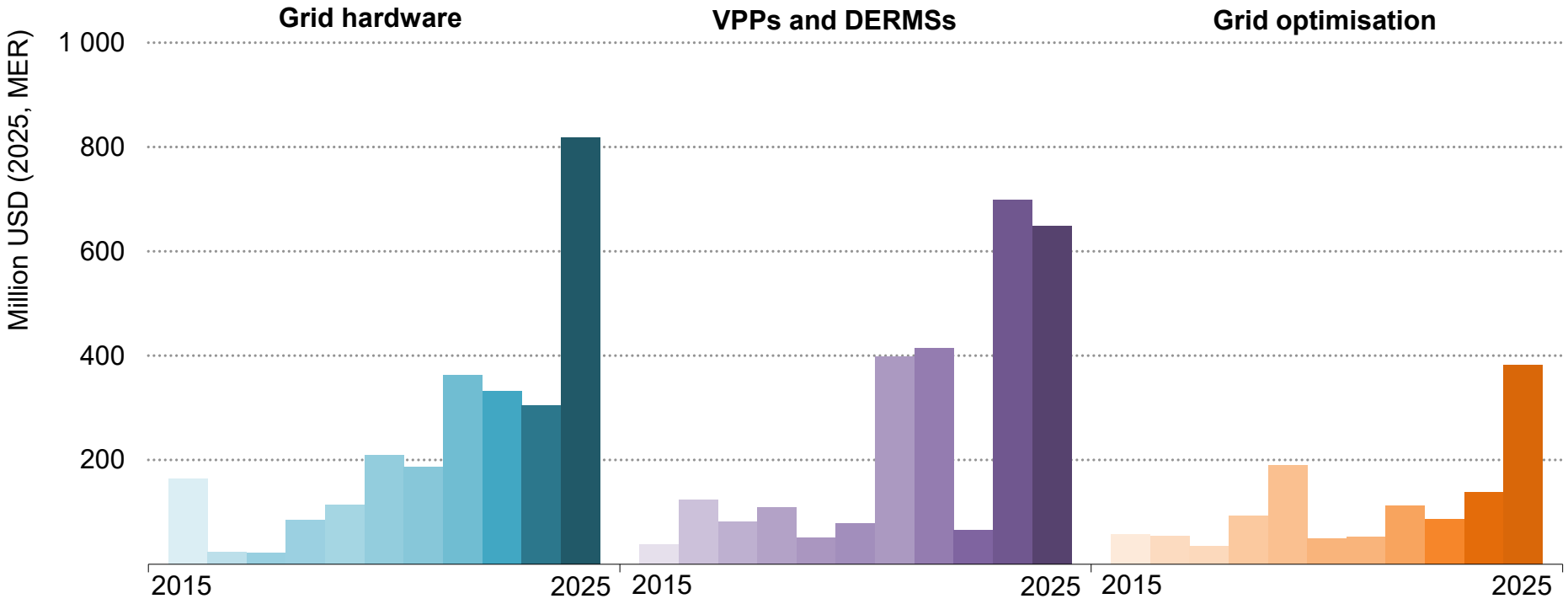
Beyond supply-chain constraints and extended equipment lead times, lengthy permitting processes and misaligned targets and policy frameworks continue to hinder grid expansion. As a result, almost 600 GW of renewable energy projects in late-stage development remained stuck in grid connection queues in 2025. Demand-side delays are also increasingly visible, with large-load connection queues lengthening rapidly for several US operators, including ERCOT and PJM, largely due to data centre expansion. In Europe, the Netherlands and the United Kingdom are facing several delays for industrial consumers and EV charging connections.

In response, policymakers and utilities are introducing new connection and planning approaches to reduce bottlenecks, including non-firm connections and "first-ready, first-served" prioritisation mechanisms. Regions with growing electrification demand are deploying policy, tariff and financing tools to support grid investment growth. In the United Kingdom, Ofgem has approved USD 13.6 billion to reinforce the electricity transmission network, improve reliability and expand capacity for electrification. Similarly, the European Commission has introduced a European Grids Package, with plans to allocate USD 565 million to support network expansion.

Progress is similar in emerging markets. In China, the State Grid Corporation has advanced its projects scheduled for 2027-2028, with an approved investment envelope of USD 100 billion in 2026. In India, where transmission bottlenecks are especially acute, the Central Electricity Authority has announced a plan to invest USD 91 billion in transmission by 2035-2036, while in Latin America, Chile and Brazil are also investing in grid development.

Venture investment growth for grid technologies indicates increasing market interest in innovative solutions to address or circumvent grid capacity bottlenecks

Venture capital investment in grid hardware, grid optimisation, VPPs and DERMSs, 2015-2025



Grid hardware solutions raised USD 818 million in 2025, with seven of the 23 transactions exceeding USD 50 million. VPPs/DERMSs reached USD 649 million and grid optimisation rose to USD 383 million.

Notes: VPP = virtual power plant. DERMS = distributed energy management system. In some cases, start-ups are included in two solution categories, with half of each deal allocated to each category (e.g. Mainspring Energy is included in both grid hardware and natural gas engines, which is not shown).

Sources: IEA analysis based on Cleantech Group (2025), i3 Connect; and Crunchbase (2025), dataset.

Innovation and resilience investments are key priorities to strengthen electricity grids

To improve grid management and accelerate connections amid equipment shortages and long lead times, utility operators are looking for technologies that enhance system management without adding risk. Incumbent manufacturers such as ABB, Honeywell, Eaton and GE Vernova are responding through acquisitions to enhance grid capabilities, while venture capital is driving innovation across hardware and optimisation, with investment reaching USD 1.2 billion in 2025.

Meanwhile, firms such as Infravision and AssetCool exemplify how capacity-enhancing solutions can attract investment, alongside advances in transformer technologies (Ampersand, Heron Power and Gridware). Major suppliers are also investing in advanced grid technologies, including AI-enabled asset management, enhanced STATCOM solutions, and sulphur hexafluoride-free switchgear.

Equipment failures have triggered power supply disruptions in Brazil, Chile, Cuba, Czech Republic, Indonesia, Mexico, Portugal, Spain, and the United Kingdom. At the same time, even as new technologies and investment flows strengthen grid capabilities, operators must confront another layer of risk: the rising exposure of grids to cybersecurity hazards and severe weather events. While recent outages have been caused largely by extreme weather, cybersecurity threats are also increasing and could lead to future disruptions. Overcoming these challenges is a key priority for utilities and policymakers, and investing in resilience is essential to ensure a durable and secure power system. For this reason, transmission and distribution companies are developing and enhancing new climate-adaptation programmes.

In Europe, utilities are investing in grid resilience to make their networks more resistant to extreme events and other disruptions. Iberdrola allocated USD 113 million under its II.Lumina Plan following the 2024 floods, while Enedis is investing USD 1.1 billion annually and RTE is dedicating 40% of its yearly budget to renewing the transmission grid to adapt to climate change. Overall, utilities in Europe direct an estimated 25-40% of their annual capital expenditures to grid resilience and modernisation initiatives. Meanwhile, the US Department of Energy has launched a Grid Resilience and Innovation Partnership, providing USD 7.6 billion in funding for 105 projects to strengthen grid resilience and reliability.

Similar efforts to reinforce grid systems are emerging across other regions as well, supported by international financing and regional co-operation initiatives. Interconnectors are viewed as a critical instrument to enhance system flexibility, as they facilitate cross-border balancing and manage VRE-related variability while reinforcing grid adequacy. Southeast Asia, for example, aims to reinforce its regional connectivity through the ASEAN Power Grid, requiring an estimated USD 27 billion by 2040 to realise its ambitions.

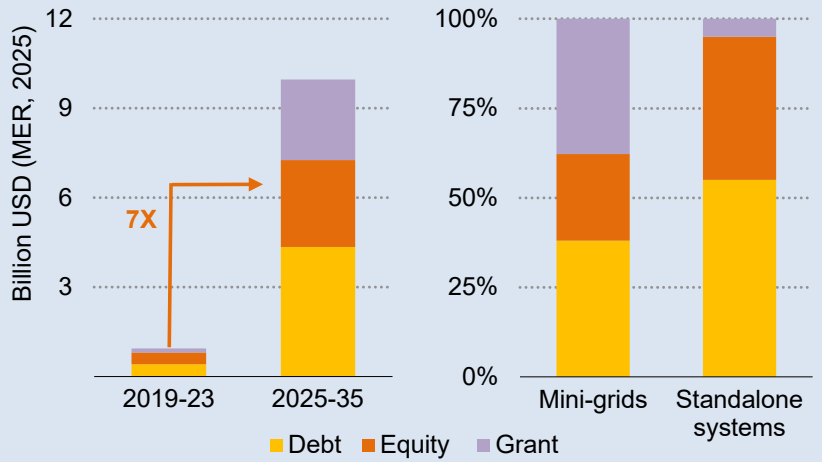
Achieving universal access to electricity will require increased financing for decentralised solutions such as mini-grids and standalone systems

In the Accelerating Clean Cooking and Electricity Services Scenario (ACCESS), universal access to electricity can be achieved by 2035 if electrification efforts accelerate to the pace of best historical achievements. This will require USD 250 billion of investment in the next decade, with over 55% to install and expand grids and the rest directed to decentralised solutions, namely mini-grids and standalone systems.

Early- and growth-stage equity is vital for project development, yet its availability has declined, especially for projects in rural areas. This has constrained expansion in the start-up stage for solar home system companies and in the growth stage for mini-grid companies. In the ACCESS Scenario, equity investment rises sevenfold to nearly USD 3 billion per year. The equity share for standalone systems reaches 40%, reflecting smaller ticket sizes and higher revenue risks due to retail consumers and less mature business models. Equity also plays a catalytic role in mobilising other sources of capital, particularly debt, which expands almost tenfold in the next decade.

Patient concessional equity grows under ACCESS assumptions, supported by increased participation from actors such as local pension funds and international public sources such as the International Finance Corporation's Zafiri Fund. Scaling equity from private sources depends not only on mobilising concessional sources but also on establishing predictable and supportive regulatory frameworks. Innovative financing structures such as financial aggregation, securitisation of company receivables, refinancing of operational assets, and blended finance solutions to reduce macroeconomic risks further enhance the feasibility of crowding in commercial capital.

Average annual investment in decentralised solutions, 2019-2035 (left) and share by financing instrument in ACCESS, 2025-2035 (right)

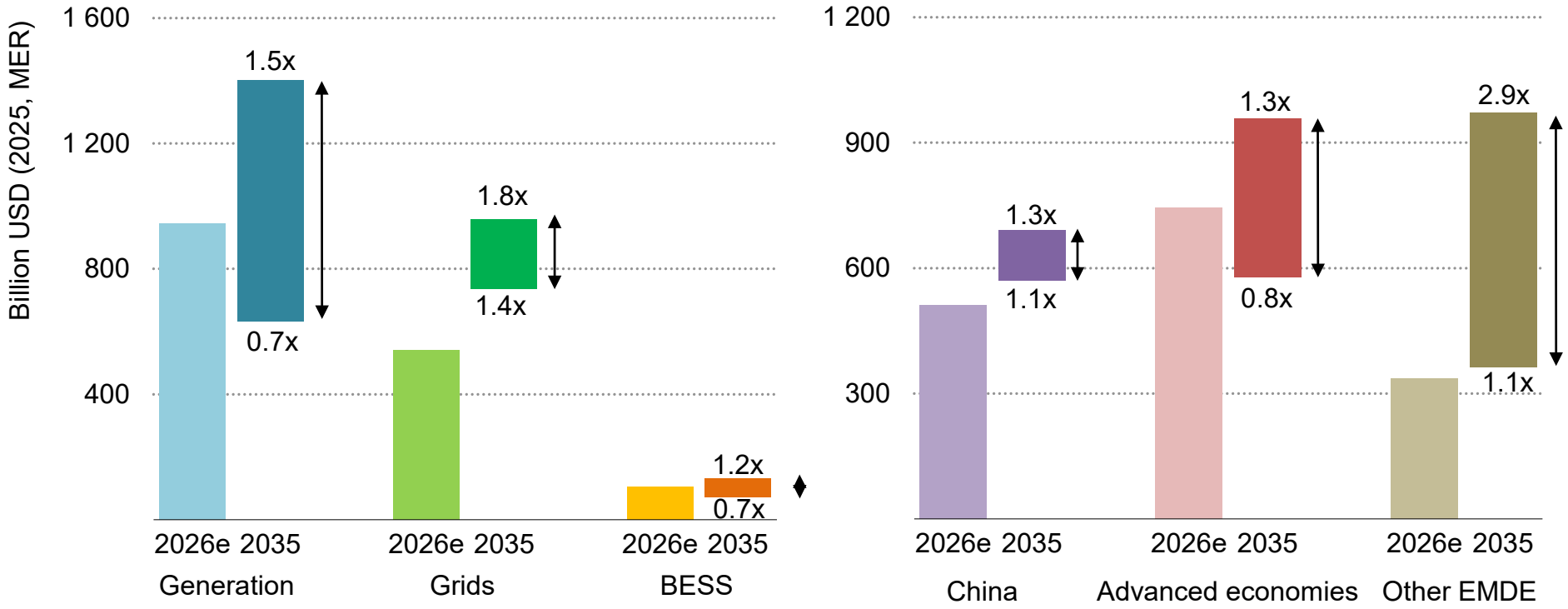


Notes: ACCESS = Accelerating Clean Cooking and Electricity Services Scenario.

Implications

Developments in emerging and developing economies outside of China will determine the overall size of the power investment opportunity over the next decade

Power sector investment by category (left) and region (right) in 2026e, and scenario range for 2035



As electricity demand is rising, there is no scenario in which power sector investment does not increase – but the magnitude of change, especially for electricity generation and EMDE other than China, is contingent on policy choices to meet demand securely and affordably.

Notes: MER = market exchange rate. 2026e = estimated. BESS = battery energy storage system. AE = advanced economy. EMDE = emerging market and developing economies. Minimum and maximum values of 2035 investment correspond to outcome ranges in IEA scenarios.

While the pace and strategies countries adopt to meet new demand and pursue energy security remain unclear, some outcomes are more certain than others

One of the findings across all IEA scenarios is the growing importance of electricity in the global energy system. In the past decade, global power sector investment has increased at a compounded annual rate of around 5% despite declining technology costs. In scenarios based on prevailing policy settings, continued cost reductions for key generation technologies and slower annual spending in some advanced economies keep future annual investment in check. However, in scenarios that rely more heavily on widespread electrification and capital-intensive low-emissions technologies, annual investments rise nearly 63% from 2026, reaching USD 2.6 trillion in 2035.

Some common elements appear across all scenarios. First, China, which consumes as much energy as Europe and the United States combined, increases its power sector investment by at least 11% relative to 2026. This alone provides a strong anchor for global investment trends.

Second, there is no scenario in which grid investment declines from today's level. Irrespective of the extent to which electricity displaces other forms of final energy, electricity demand continues to rise, particularly in EMDE, driving grid investment growth of about 30-70% by 2035 relative to 2026. The nature of grid investments is nevertheless likely to evolve as new solutions to cost-effectively meet demand and enhance system flexibility mature. Digital technologies that improve maintenance, extend asset lifetimes and boost utilisation, for example, could defer an estimated USD 1.8 trillion of grid investment globally to 2050.

Third, although the amount of additional new generation capacity varies substantially across scenarios, relative investment shares for generation technologies are broadly consistent. Under today's policy settings, solar and wind account for around 60% of cumulative generation investment between 2026 and 2035, nuclear for 11% and hydro for 10%. More ambitious pathways increase the solar and wind share to around 70%, while nuclear and hydro shares remain virtually unchanged. This underscores the need for a diverse portfolio of complementary technologies to create a secure and efficient electricity system, including baseload and dispatchable power.

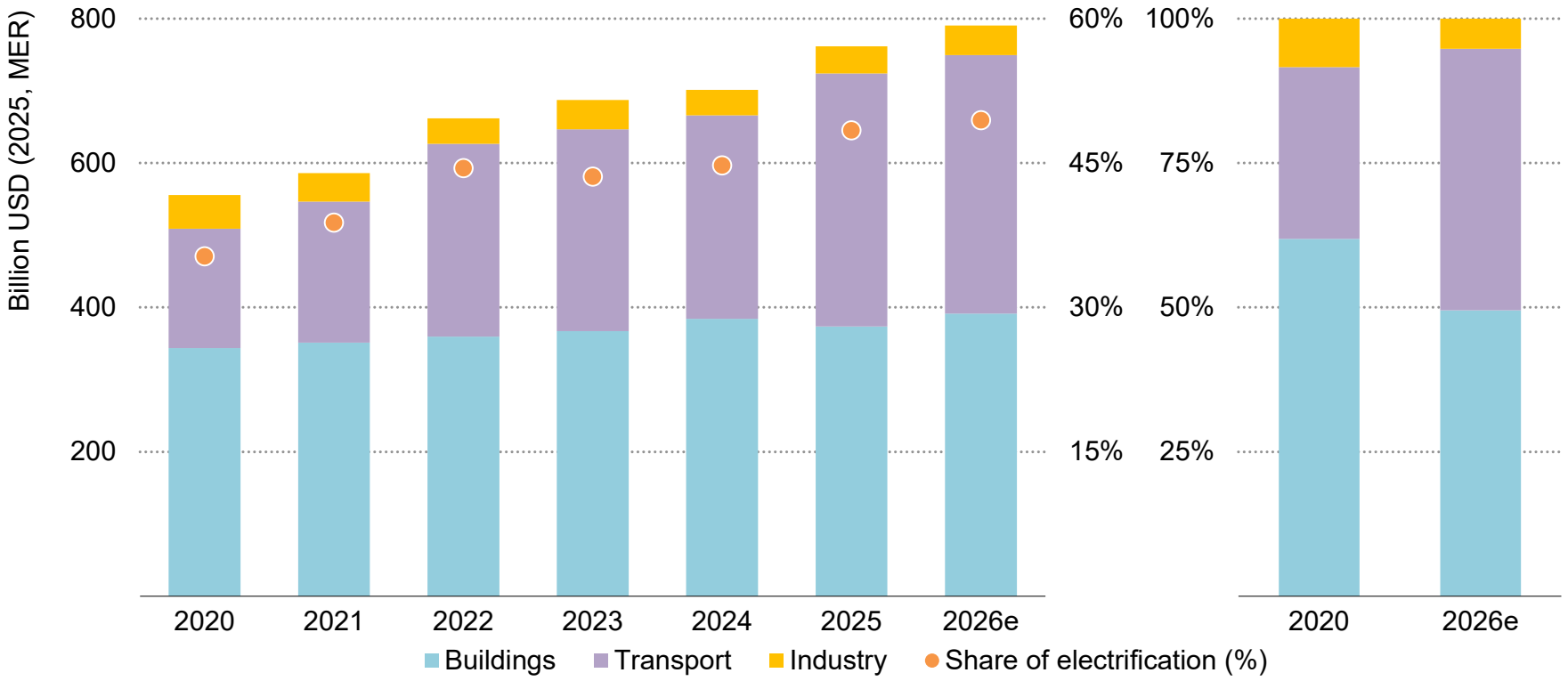
While uncertainty surrounding data centre load growth in the United States has attracted considerable attention, EMDE show the largest divergences between scenarios. Today's turbulent fuel markets are likely to reinforce a preference for domestically available resources to meet rapid growth in power demand. While this may keep coal in the mix for longer in some countries, solar and wind remain widely accessible, meaning that investment in a broader portfolio of renewables – alongside nuclear – has the greatest upside potential.

Demand and electrification

Overview

Investment in energy efficiency and electrification across buildings, transport and industry continues to rise

Global investment in energy efficiency, electrification and renewables for end-uses by sector, 2020-2026e



Global investment in the energy efficiency and electrification of buildings, transport and industry is growing steadily, reaching close to USD 800 billion in 2026. However, differences in pace, composition and financing across sectors are emerging.

Notes: MER = market exchange rate. 2026e = estimated.

Investing in efficiency and electrification is critical to meet rising demand for energy services

Rising demand for energy services is influencing energy investment trends more profoundly than any single price cycle, policy shift or technology breakthrough. Across buildings, transport and industry, growth in cooling, mobility, digital infrastructure and industrial output is accelerating just as energy systems are becoming more electrified. Decisions in these sectors (e.g. the appliances people buy, the vehicles they drive and the equipment that firms operate to cater to consumers) reflect the close links between energy systems and everyday economic activity. Energy investments in these areas are thus critical to the affordability, security and resilience of the energy system as a whole.

This makes energy efficiency a central component of energy investment, in conjunction with electrification. Unlike supply-side capital flows, end-use investments must scale across millions of assets, technologies and decision makers. It is in this domain that demand for services becomes demand for energy, determining in turn requirements for new supply-side assets, fuels and infrastructure, and locking in future emissions trajectories.

In periods of geopolitical uncertainty, these choices also take on heightened strategic importance: investment in efficiency and electrification can reduce exposure to volatile fuel markets, lower import dependence and ease pressure on energy systems during supply disruptions. The speed and direction of end-use investments therefore shape not only climate outcomes but also electricity system requirements, energy security, household affordability and industrial competitiveness.

Across all three end-use sectors, efficiency and electrification advance for different reasons and at varying speeds. Energy efficiency remains the most resilient investment category (roughly USD 366 billion), particularly in buildings and industry, reflecting lower risk, proven returns and compatibility with existing financing structures. Electrification – through heat pumps, electric vehicles (EVs) and electrified industrial processes – is expanding rapidly, with investment growing around 15% year-on-year, offering prospects for scalability and technological maturity. Yet, its progress is uneven, accelerating when infrastructure, prices and finance align, and slowing when affordability, grid readiness or technology risk barriers persist.

This chapter focuses on both the volume of investment flows and who is investing. In the buildings sector, households play a prominent role in investment decisions, making upfront costs, affordability and consumer confidence critical components of decision criteria. In transport, investment decisions are likewise made by consumers, with their choices shaped by policies and the rapidly evolving industrial and trade strategies of automakers and infrastructure providers. In industry, corporate balance sheets, competitive pressures and payback expectations often steer capital toward incremental upgrades rather than deep transformations, with the

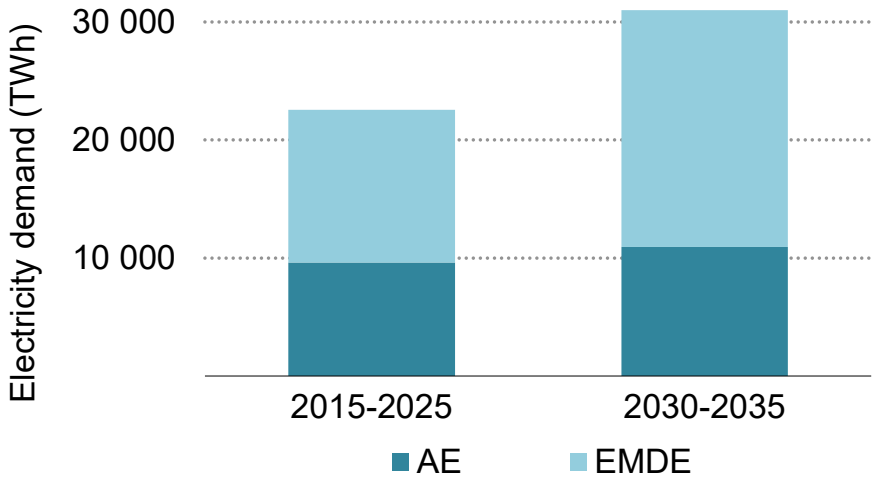
latter typically requiring substantial policy support. These factors explain why similar technologies can scale rapidly in one sector or region while stagnating in another.

Financing conditions cut across all end-uses as a powerful determinant of outcomes. Public funding, consumer credit, corporate liquidity, risk-sharing mechanisms and policy-linked finance influence which technologies move from pilot to scale. Investments in buildings remain the most dependent on public finance and guarantees to absorb risk. Meanwhile, transport investment is increasingly tied to vehicle affordability and industrial policy support. In industry, investment continues to be filtered through strict risk and return thresholds. In emerging market and developing economies that will drive future electricity demand, high borrowing costs and limited access to long-tenor capital intensify these constraints.

As a result, end-use investment is rising, but rarely at the pace needed to mitigate supply strains or in the places that have the most rapidly growing energy service needs. Technology is available and capital exists, but misalignments between demand growth, financing structures and risk allocation create persistent bottlenecks. These challenges are being further exposed by recent geopolitical shocks, including the Middle East conflict, which has heightened energy security concerns, disrupted trade routes and reinforced the urgency of managing demand growth alongside supply. This chapter is therefore as much a look at whether efficiency and electrification are advancing, as it is an observation of whether investment is being mobilised quickly and effectively enough to meet the scale of change.

Across buildings, transport and industry, this chapter shows how energy demand growth, investment actors, financing conditions and technology maturity together determine the speed and direction of efficiency and electrification – and where gaps remain that will shape the next phase of energy investment.

Global electricity demand from buildings, transport and industry in the Stated Policies Scenario, 2015-2035

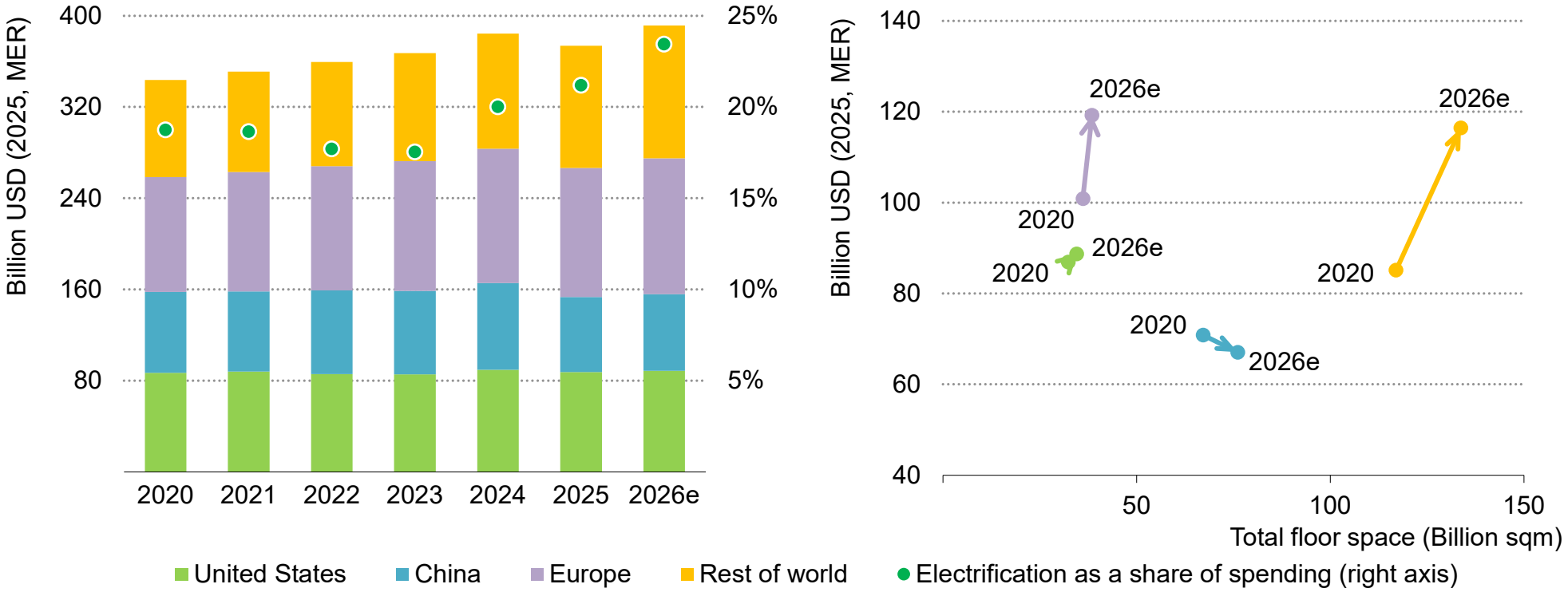


Notes: AE = advanced economies. EMDE = emerging market and developing economies.

Buildings

Investment in buildings recovers in 2026, with electrification gaining a larger share of spending

Investment spending on energy efficiency, electrification and renewables in the buildings sector, 2020-2026e



Buildings investment is edging up again in 2026, following a weaker 2025 due to subdued construction activity, with electrification leading growth. Floor space additions slow in major markets but continue to rise elsewhere, shaping diverging investment trends.

Notes: MER = market exchange rate. 2026e = estimated.

Public funding remains the main risk absorber for buildings investment even as stimulus support fades

Public funding continues to be a central driver of energy-related investment in buildings in 2026, particularly for efficiency and electrification projects that have high upfront costs and long payback periods. While regulations such as building codes, minimum energy performance standards and labelling schemes continue to stimulate baseline investment, public funding plays a more targeted role by enabling investment beyond mandated requirements – most notably in deep renovations, retrofits and selected electrification measures.

As the broad-based stimulus packages of the early 2020s are phased out in some regions, public support increasingly operates through more focused instruments, including renovation subsidies, targeted electrification incentives, regulatory frameworks coupled with financial support, and credit-enhancement schemes. As a result, regional investment trends in 2026 reflect not only differences in construction activity, but also the complementarity of public funding and regulatory approaches to mobilise additional efficiency and electrification investments.

In the European Union, 2026 is a decisive year for programme implementation under the NextGenerationEU Recovery and Resilience Facility, with a large share of its EUR 577 billion of funds still to be committed before the end-2026 deadline. In early 2026, only around 60% of the facility's funding had been disbursed, leaving around EUR 270 billion yet to be allocated. Since at least 37% of spending must support climate objectives, much of the funding is being directed towards building renovations, heat pump deployment and upgrades to social housing, leading to a concentration of projects in countries with large remaining allocations.

In the United States, public support remains substantial but more uneven following the legislative changes of 2025. Still-available transferable tax credits provide liquidity for developers and commercial projects, but some consumer-facing incentives are being phased out, creating uncertainty for household retrofit programmes. Strong demand for rebates created concerns over the availability of funding in several states, signalling that efficiency and electrification investments continue to depend on public schemes, even though overall fiscal support is becoming less predictable.

In China, public policy continues to sustain renovation activity despite a structural slowdown in the real estate sector. Government-backed programmes targeting older urban housing remain a major funding source: renovations began in over 27 000 communities in 2025, covering nearly 5 million households and involving spending of about RMB 133 billion. These programmes are part of a broader shift from constructing new buildings to upgrading existing stock, and continued

expansion in heating electrification and green-building standards are supporting steady growth in electricity use in buildings.

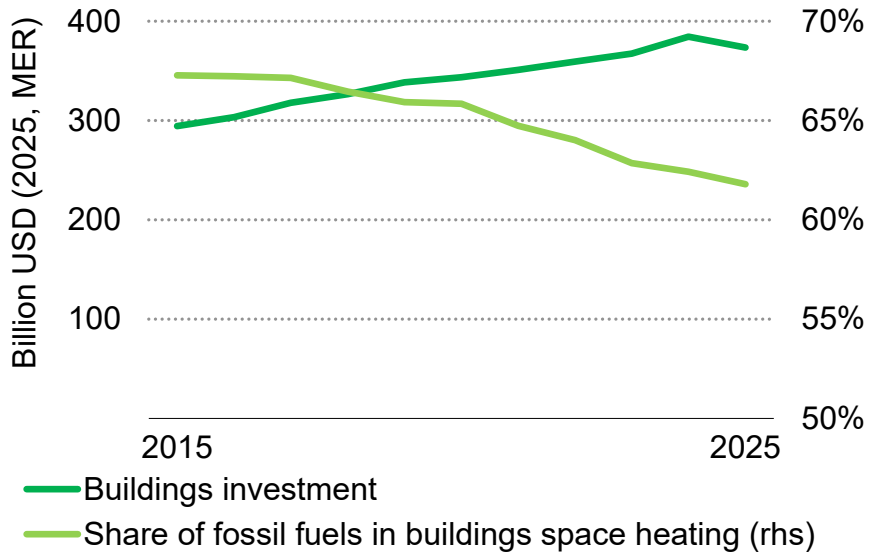
In other parts of the Asia-Pacific, the shift away from stimulus measures is less pronounced because energy security concerns are driving renewed public spending on efficiency and electrification. Net fossil fuel importers such as Japan and Korea are scaling up programmes to reduce exposure to fuel price volatility, with buildings-sector efficiency and electrified heating receiving increased policy support.

In Korea, national and local governments have strengthened building-efficiency policies, introducing additional subsidies to electrify heating and install heat pumps, as well as a dedicated buildings-sector energy efficiency improvement scheme for low-income households starting in 2026. In Japan, government-backed programmes continue to support the deployment of high-efficiency heat pumps and advanced climate systems, in line with the Strategic Energy Plan's emphasis on electrifying heat and improving buildings' resilience to energy-market volatility.

In emerging market and developing economies, more buildings-sector investment is spent on floor space expansion than on retrofits, but public finance remains critical for efficiency and electrification. Rapid urbanisation is adding considerable new construction each year, while cooling demand is the fastest-growing end-use in buildings. High borrowing costs and fiscal constraints limit the scale of domestic programmes, leaving efficiency investments dependent on concessional finance and international support in many regions.

Overall, buildings investment in 2026 continues to rely heavily on public funding, but the form of support is evolving. Instead of offering broad stimulus, government programmes are increasingly tied to renovation targets, equipment standards and financing support, making the stability of policy frameworks a key factor in the deployment of efficiency and electrification investments across regions.

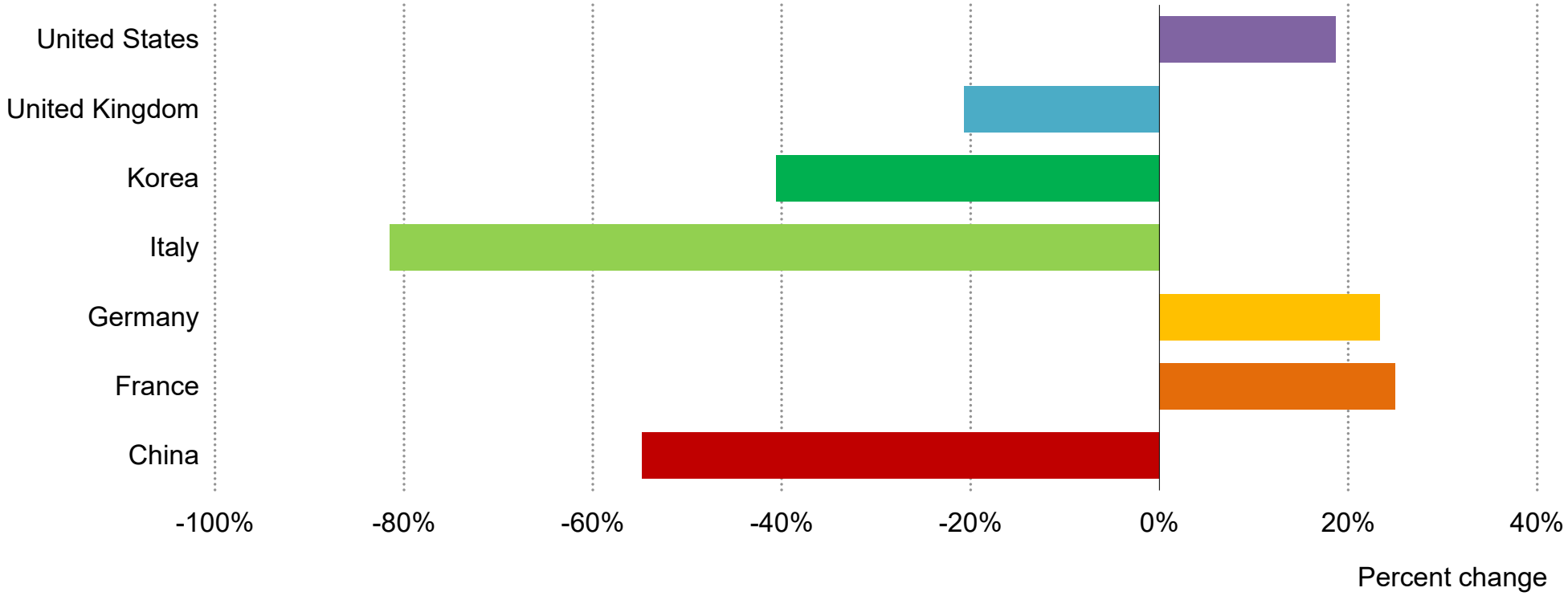
Buildings-sector energy efficiency and electrification investments, and fossil fuel shares in space heating, 2015-2025



Note: MER = market exchange rate.

Public funding has shaped the path of energy efficiency investment in buildings

Changes in public funding programmes for buildings-sector energy efficiency in selected countries, 2022 vs. 2025



Since changes in funding for buildings strongly shape investment patterns, countries that maintain support have more stable activity. When funding shrinks, investment slows, showing how extensively the buildings sector depends on reliable public backing.

Notes: Changes are expressed in percentages, calculated as the difference in funding levels between 2022 and 2025. Coverage is limited to countries with a consistent set of comparable policy schemes over the period. Percent changes do not reflect comparative total budget amounts among countries.

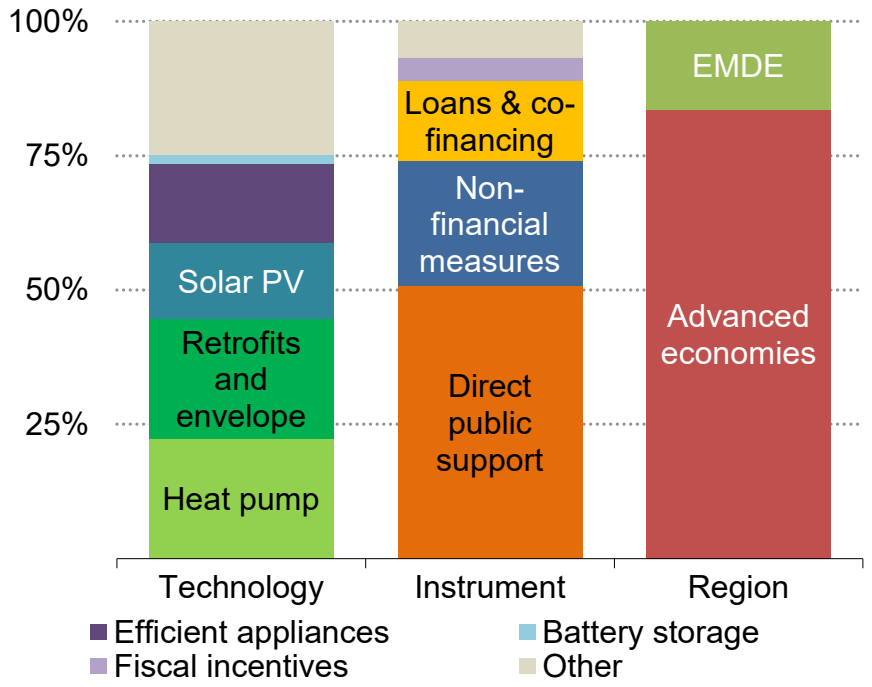
Household-led investment remains sensitive to affordability and upfront cost risks

Households account for around half of investment in buildings energy efficiency, but compared with commercial actors, their decisions are more strongly affected by upfront costs, fuel prices and access to public support. Retrofit and electrification measures often require upfront spending of tens of thousands of dollars per dwelling. As a result, these investments remain discretionary and depend on whether higher capital costs can be credibly recovered through lower energy bills. As buildings become more electrified, consumer confidence is a central determinant of momentum in 2026.

Electrification is the clearest signal of structural change in the sector. Buildings are expected to account for half of global electricity demand growth through 2030, largely reflecting residential adoption of electric heating, cooling and appliances. While households dominate markets such as heat pumps and room air conditioners, uptake remains tightly linked to relative fuel prices. Experience across markets suggests that uptake slows when electricity costs exceed roughly two times the price of gas, highlighting the importance of taxation, subsidies and regulated pricing in investment decisions.

At the same time, policies targeting building retrofits and efficient appliances are increasingly influencing household investment. Most recent measures are directed at households and rely primarily on direct subsidies and grants to overcome upfront cost barriers. By combining efficiency standards with targeted financial support, these policies enable households to reduce their energy bills and adopt electrified and distributed technologies, reinforcing the central – but highly policy-dependent – role of households in buildings-sector energy investment in 2026.

Demand-side affordability policies supporting household energy efficiency investments, 2025



Note: EMDE = emerging market and developing economies.
Source: IEA (2026), Household Energy Affordability.

Commercial investment hinges on construction and balance sheet conditions

In contrast to household decisions, energy-related investment in commercial and public buildings in 2026 depends more on construction activity and corporate balance-sheet conditions than on public subsidy schemes. As construction stabilises, investment is recovering gradually rather than accelerating sharply, with global construction output projected to grow around 2.9% in 2026. Instead of stimulus-driven growth, spending is increasingly shaped by refinancing needs, asset-quality requirements and differences across construction segments.

A key driver for commercial energy-related investment in 2026 is the refinancing cycle affecting the global commercial real estate sector. Around USD 3 trillion in commercial property debt is scheduled to mature between 2025 and 2027, much of it issued during a period of lower interest rates. In a higher-cost financing environment, owners must demonstrate stronger operating performance to secure new loans, increasing the value of efficiency and electrification upgrades.

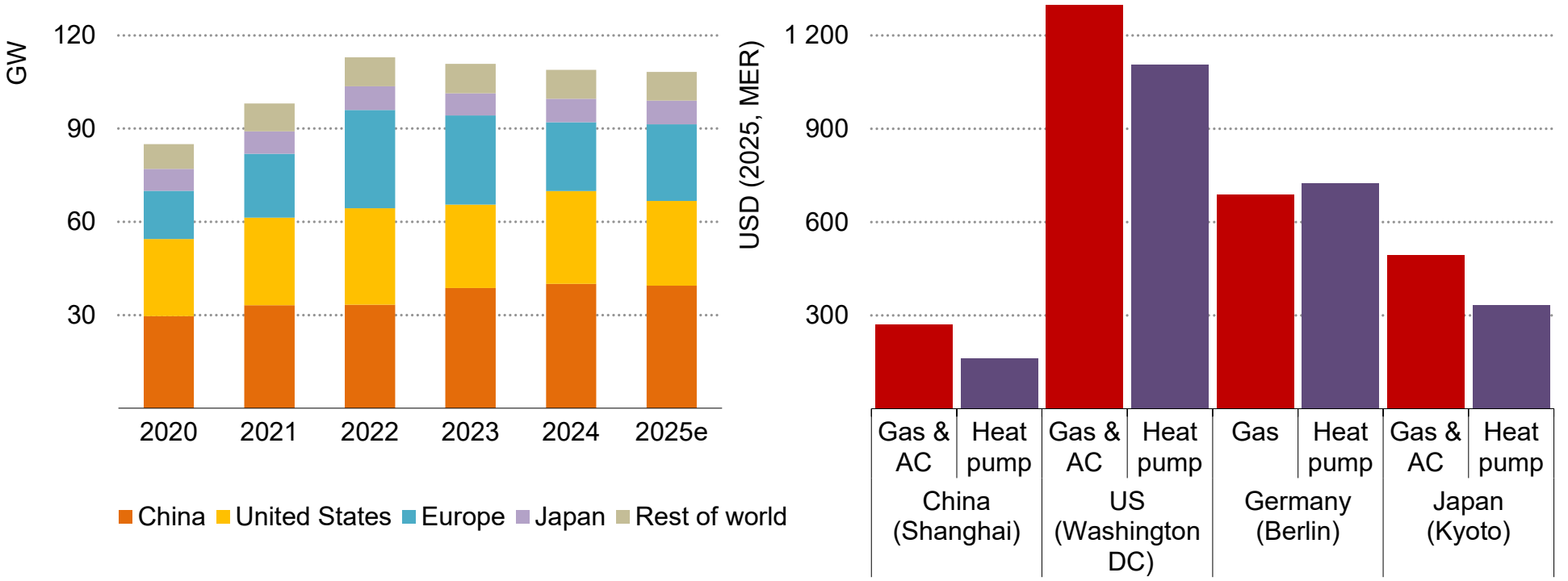
While lower energy costs help lift net operating income to meet tighter lending standards, inefficient assets will be subject to greater "brown discounts" and reduced access to credit. In this context, recapitalisation can make retrofit programmes for envelope improvements, electrified heating and cooling, and digital energy-management systems more attractive.

Financing standards are also tightening. Industry surveys indicate that more than 80% of lenders and investors now rank energy efficiency among the most important conditions for accessing debt and equity. Buildings with weak performance are increasingly priced to reflect anticipated upgrade costs and regulatory risk, resulting in valuation discounts of up to 15-20% in markets where minimum energy performance standards constrain leasing. Evidence from the United Kingdom and the Netherlands shows that inefficient assets underperform primarily because of weaker capital growth, reinforcing a shift whereby commercial energy upgrades are driven more by refinancing eligibility, tenant demand and asset liquidity.

Construction trends are also diverging across segments, with digital infrastructure claiming a growing share of new investment. Indeed, global data centre investment is projected to reach roughly USD 3.9 trillion cumulatively between 2026 and 2030, including about USD 480 billion in additional energy-related capital expenditure. While data centres remain a relatively small contributor to global buildings-sector energy demand, their rapid expansion and power density mean they have a disproportionate impact on local electricity systems. As a result, a growing share of new non-residential construction is concentrated in facilities that rely on advanced electrical systems, cooling technologies and energy-management solutions, reinforcing the importance of efficiency and electrification.

Heat pump sales stabilise as the share of electrification in investment reaches a record high

Global heat pump sales, 2020-2025 (left) and estimated annual average residential heating and cooling costs, 2024 (right)



While global heat pump sales remained broadly flat in 2025, electrification increased to the highest-ever level, confirming that heat pumps are delivering competitive heating and cooling services across major markets.

Notes: MER = market exchange rate. AC = air conditioning. Annual costs are based on the levelised cost of heating and cooling, including annualised unit and installation costs and operating expenditures without subsidies.

Sources: IEA (2026), Global Energy Review 2026; IEA (2026), Energy Technology Perspectives 2026.

In emerging market and developing economies, buildings investment growth is led by new construction while efficiency gains depend on access to finance and implementation

In 2026, EMDE investments in buildings continue to focus on building-stock expansion rather than on deep renovations. Excluding China, total floor space is expect to grow by 2.5 billion m² in 2026, with construction activity growing in the range of 4.8% to over 6%, nearly three times the rate in advanced economies. As a result, most capital deployed in the sector is directed towards new construction, while deep retrofit activity remains limited, reflecting younger building stock, weaker enforcement of building codes and more limited access to financing for small-scale projects.

Rapid floor space expansion is accompanied by rising demand for cooling, which is the fastest-growing end-use in buildings in many EMDE countries. Higher temperatures, urbanisation and rising incomes are driving strong growth in air conditioning. Thus, improving the efficiency of new equipment is becoming critical to avoid sharp increases in electricity demand, with policies promoting higher-efficiency appliances and minimum performance standards. While evidence of widespread expansion remains limited, district cooling and other centralised systems are starting to be deployed in some fast-growing urban areas to help manage cooling demand and electricity loads.

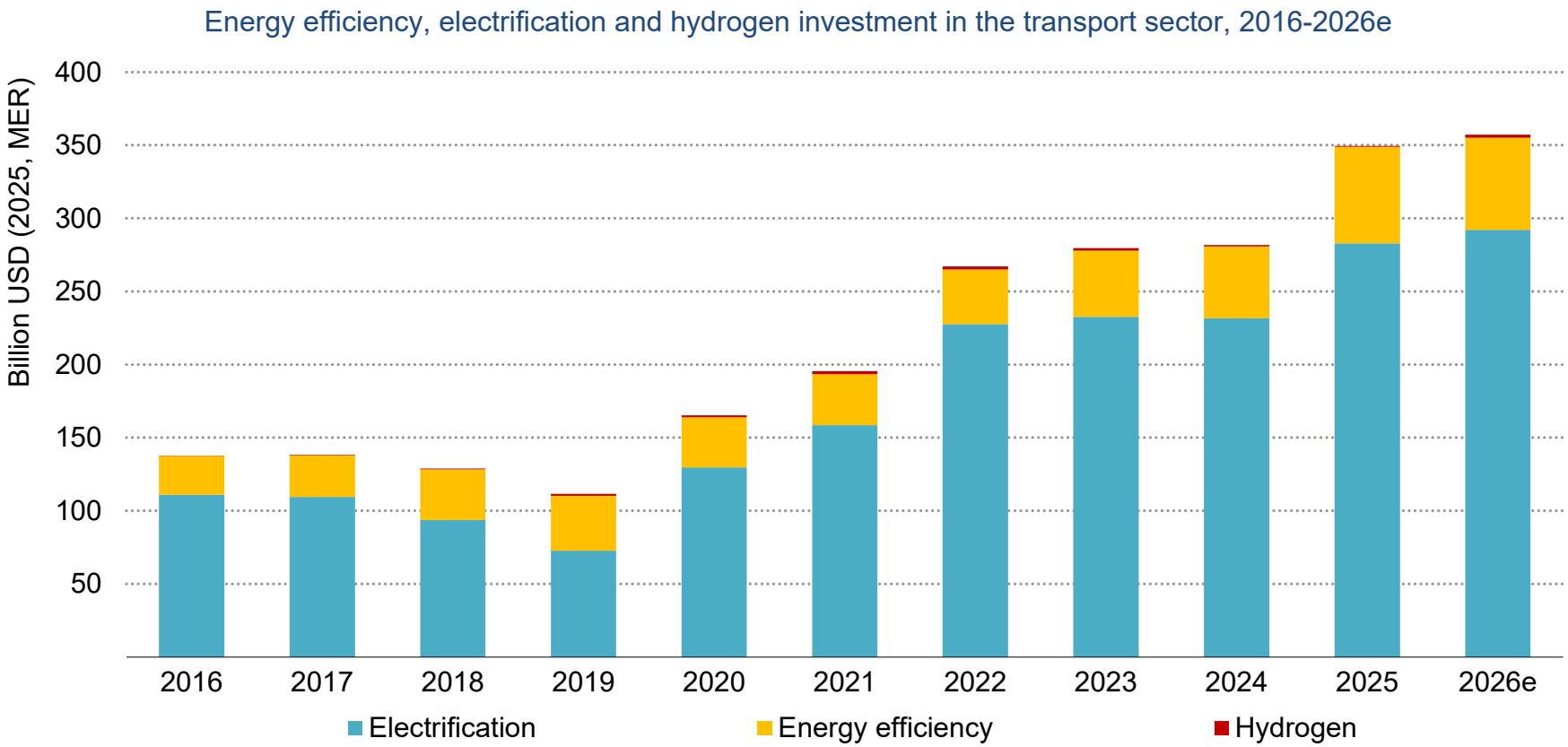
Despite strong construction growth, investment in efficient and electrified buildings remains constrained by financing conditions. Outside of China, EMDE clean energy investment is still low relative to demand, with high borrowing costs, fiscal pressures and weak utility balance sheets slowing the rollout of efficiency programmes and electrification.

International public finance continues to support buildings-related EMDE investments, but flows are often fragmented and concentrated on system-enabling projects. Recent commitments show more energy-efficiency activity in public buildings and widespread support for distribution upgrades, smart metering and last-mile electrification projects that underpin building electrification.

Delivery will differ by region. In Africa, distribution rehabilitation and access and interconnection projects such as the Tanzania-Zambia transmission interconnector dominate the project pipeline, while in South and Southeast Asia, efficiency and cooling upgrades are often part of broader grid-modernisation packages and distribution-strengthening programmes. Latin America shows a similar systems-first profile with distribution modernisation and network efficiency investments, such as the Santander distribution programme in Colombia. Because these interventions are relatively granular, implementation and grid-readiness conditions will shape 2026 outcomes, with electrification and efficiency gains accumulating through many smaller projects rather than a few large investments.

Transport

Electrification remains the main driver of transport investment growth



Electrification investment has more than doubled over the past decade, receiving around four-fifths of total investment. The remainder is directed to energy efficiency and hydrogen.

Notes: MER = market exchange rate. 2026e = estimated. “Electrification” includes battery electric and plug-in hybrid electric vehicles, fuel cell road vehicles, EV charging infrastructure, and electricity use in rail, navigation and aviation. Vehicles for both electrification and efficiency comprise cars, buses, road freight vehicles and two-/three-wheelers. Hydrogen spending in the transport sector is low and not clearly visible on the figure; it is included for completeness.

Global transport investment grows moderately in 2026, while regional patterns and industrial strategies continue to diverge

Global transport investment, which reflects the additional cost of more efficient or lower-emissions technologies relative to a conventional baseline, is projected to reach roughly USD 360 billion in 2026, with a modest growth of 2%. Electrification remains the main driver and largest component, led by EV investment at around USD 295 billion, followed by rail electrification at around USD 44 billion, and public EV charging investments at nearly USD 32 billion. Around one-fifth of total transport investment in 2026 is estimated to be directed towards energy efficiency improvements.

Regional differences in the speed of electrification remain marked, with China and Europe allocating around 90% of all transport-sector energy investment to electrification, while the share in North America exceeded 75%. Efficiency-related investment also remains important, particularly for replacing older road and rail vehicles with newer, less energy-intensive alternatives.

Industrial strategy is playing an increasingly important role in shaping transport investment. In 2025, tariffs, market-access concerns and localisation requirements continued to influence the geographical allocation of capital across the EV value chain. Chinese automakers' foreign investments in EVs, batteries and battery materials exceeded USD 15 billion in 2025, around ten times the 2019-2021 annual average as companies expanded their overseas manufacturing capacity in response to rising trade barriers and intensifying domestic competition.

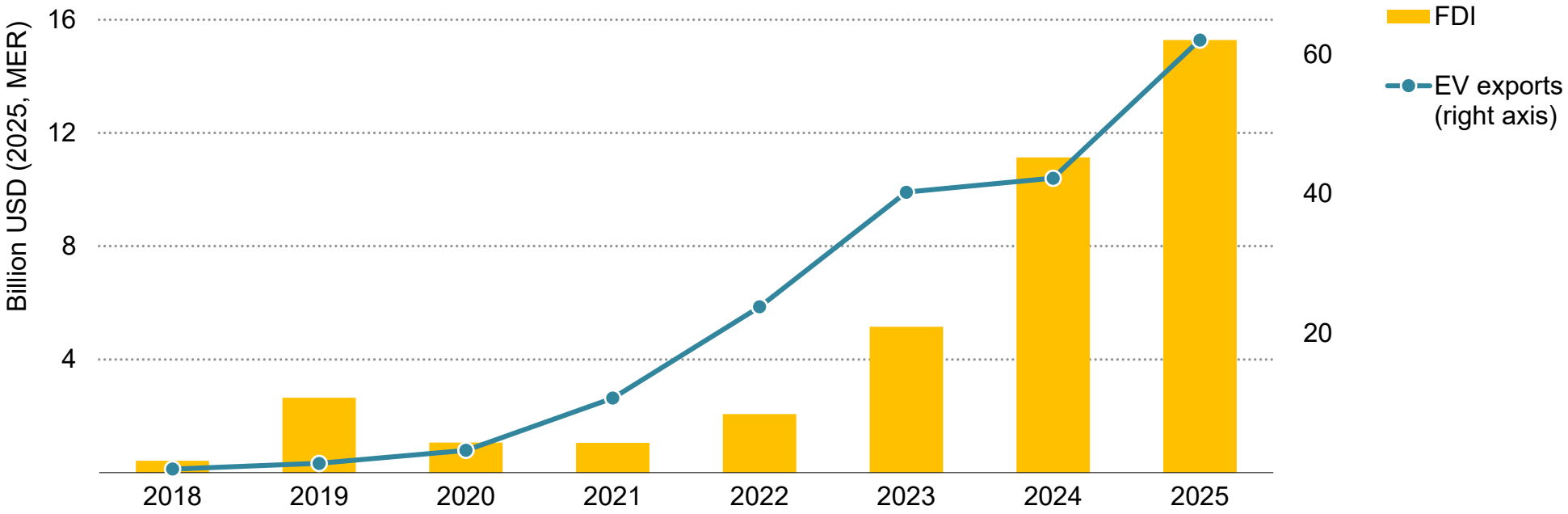
At the same time, China's EV exports also grew to nearly USD 70 billion in 2025, around seven times the 2021 level. Although Chinese automakers are investing more in overseas production, exports continue to account for the majority of supply to foreign markets, particularly in emerging market and developing economies. This changing industrial landscape is also affecting investment decisions by incumbent automakers outside of China.

In 2025 and early 2026, major legacy manufacturers (e.g. Ford, General Motors, Stellantis and Honda) announced EV-related write-downs and charges totalling at least USD 65 billion, reflecting weaker-than-expected demand in some markets, policy changes, and the reassessment of earlier investment plans.

These developments indicate that transport investment is becoming more selective. While capital continues to flow towards lower-cost manufacturing, batteries and strategic overseas capacity, some automakers in advanced economies are scaling back parts of their EV programmes and reallocating investment towards hybrids, internal combustion engine vehicles, or more targeted electrification strategies.

China's overseas electric vehicle expansion is increasingly driven by foreign direct investment that expands manufacturing bases abroad, alongside maintaining export dominance abroad

Chinese investment in overseas electric vehicle manufacturer and electric vehicle exports, 2018-2025



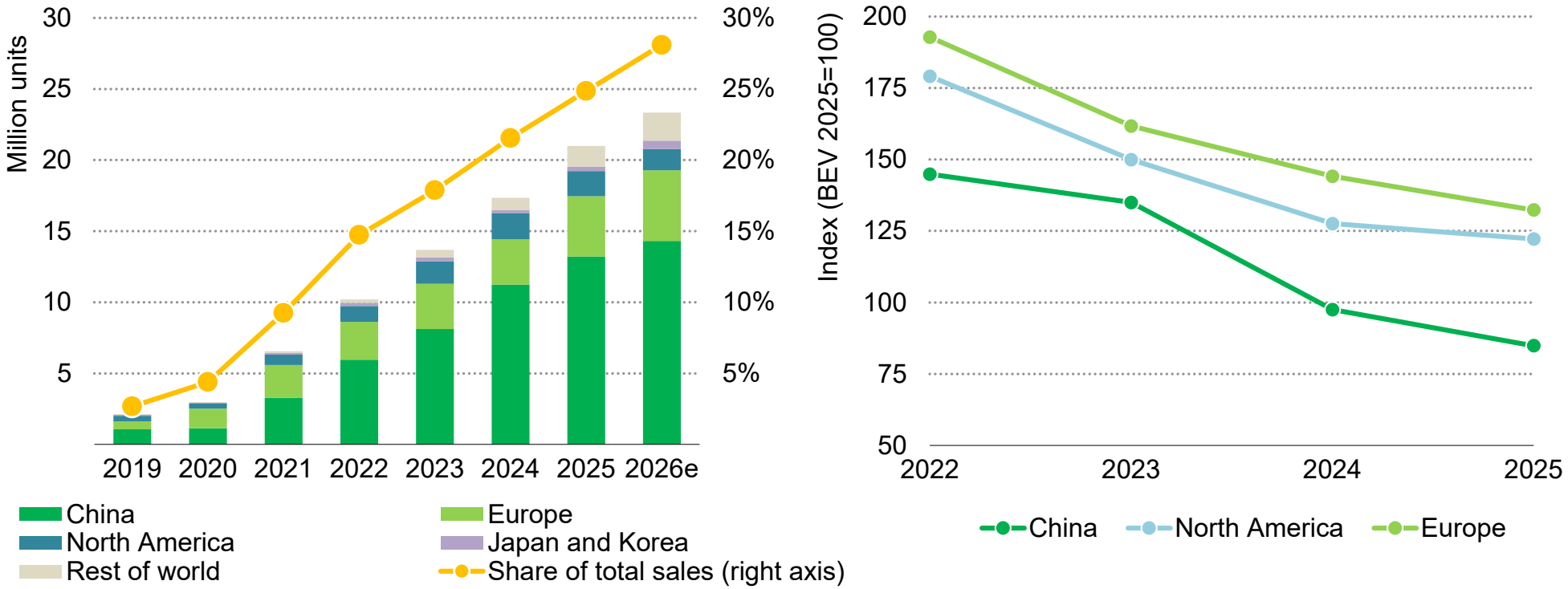
China's outbound-EV value chain investment exceeded USD 15 billion in 2025, around 10 times the 2019-2021 average, while EV exports approached USD 62 billion in 2025, around 12 times the 2019-2021 average.

Notes: MER = market exchange rate. FDI = foreign direct investment. EV = electric vehicle. Data reflect major FDI transactions valued at >USD 5 million. FDI data cover battery materials, batteries and EVs. Export data, from the International Trade Centre's Trade Map, include only EVs – not batteries or battery parts (870124, 870240, 870360, 870370, 870380, 870460, 871160).

Sources: IEA analysis based on data from Rhodium Group (2026), China Cross-Border Monitor.

Electric vehicles reached a milestone in 2025, accounting for one-quarter of new car sales globally, with growth continuing in 2026

Global EV sales, 2019-2026e (left) and average lithium-ion battery pack price per indexed watt-hour by region, 2022-2025 (right)



EV sales gained strong momentum in emerging market and developing economies, supported by falling battery prices, the growing availability of more affordable models, and supportive government policies.

Notes: BEV = battery electric vehicle. 2026e = estimated. The BEV 2025 index is the global average BEV battery price in 2025. Regional prices refer to weighted averages across all applications.

Sources: IEA analysis based on data from Bloomberg New Energy Finance (2026).

All emerging market and developing economies – not just China – are rising as the new growth driver for EV demand, owing to affordable models and expanding financing options

In 2025, almost 21 million electric cars were sold worldwide (more than a 20% increase from 2024), making up 25% of all new car sales globally. Strong growth was recorded in both China (18%) and Europe (33%), while North American sales contracted for the first time since the Covid-19 pandemic. Although global growth is expected to moderate in 2026, a notable feature of 2025 was the increasingly important role of emerging market and developing economies other than China in driving EV adoption.

Viet Nam especially stood out in 2025, with its market share doubling within a year and EVs making up about 40% of new car sales. Thailand's EV sales share rose to nearly 25%, Uruguay to almost 30% (around Europe's level), and Indonesia reached to 15%, surpassing both Korea and the United States. This indicates that EV adoption is becoming more geographically diverse, enabled by the growing availability of more affordable EV models, particularly from China.

China's EV market continued to expand strongly in 2025, with sales reaching over 13 million units. Extension of its vehicle trade-in programme helped sustain demand, while Chinese manufacturers continued to scale at home and abroad. Additionally, BYD reinforced China's global lead in 2025 by overtaking Tesla as the world's largest EV seller, recording 4.6 million vehicles in sales. In fact, its total vehicle sales have surpassed that of Ford's that sold 4.4 million units, underscoring the growing weight of Chinese firms in the global auto industry.

Europe, particularly Germany and France, recovered strongly in 2025 after the slowdown that followed its subsidy cuts, with EV sales rising 33% to more than 4 million units. A shift in the policy mix underpins these trends. While purchase subsidies still play a role in some markets, support for EV uptake in 2025 also relied on tax incentives, company-car protocol, fleet-focused measures and emissions regulations. Belgium is a notable example, where company-car tax incentives have strongly favoured EV adoption. In contrast, France ended its traditional ecological bonus for new passenger cars on 1 July 2025 and shifted support towards more targeted schemes, moving from a broad state-funded purchase subsidy to a more selective framework based on income, vehicle eligibility and social leasing for lower-income households. Türkiye also stood out in 2025, with its EV sales doubling to make up over 20% of total new car sales.

In the United States, EV sales declined slightly to around 1.5 million units in 2025 – about 10% of total new car sales – as policy support weakened following the expiry of federal EV tax credits in October 2025. Conversely, Latin America emerged as one of the most dynamic regions for EV uptake in 2025, supported by the growing availability of lower-cost models, particularly from China. Its EV share more than tripled from 2023 to make up 7% of total car sales.

While EVs still account for the majority of road transport electrification, electric buses and trucks are gaining momentum. In 2025, global electric bus sales reached nearly 70 000, up 12% year-on-year, while electric truck sales surpassed 400 000 for the first time, doubling from 2024. China remained the dominant market for both segments, accounting for most electric bus sales and more than 90% of electric truck sales in 2025. Europe remained the second-largest electric bus market, with sales rising to more than 12 000 in 2025, while India held its position as the third-largest market and Latin America recorded particularly strong growth, with sales more than tripling to above 3 000.

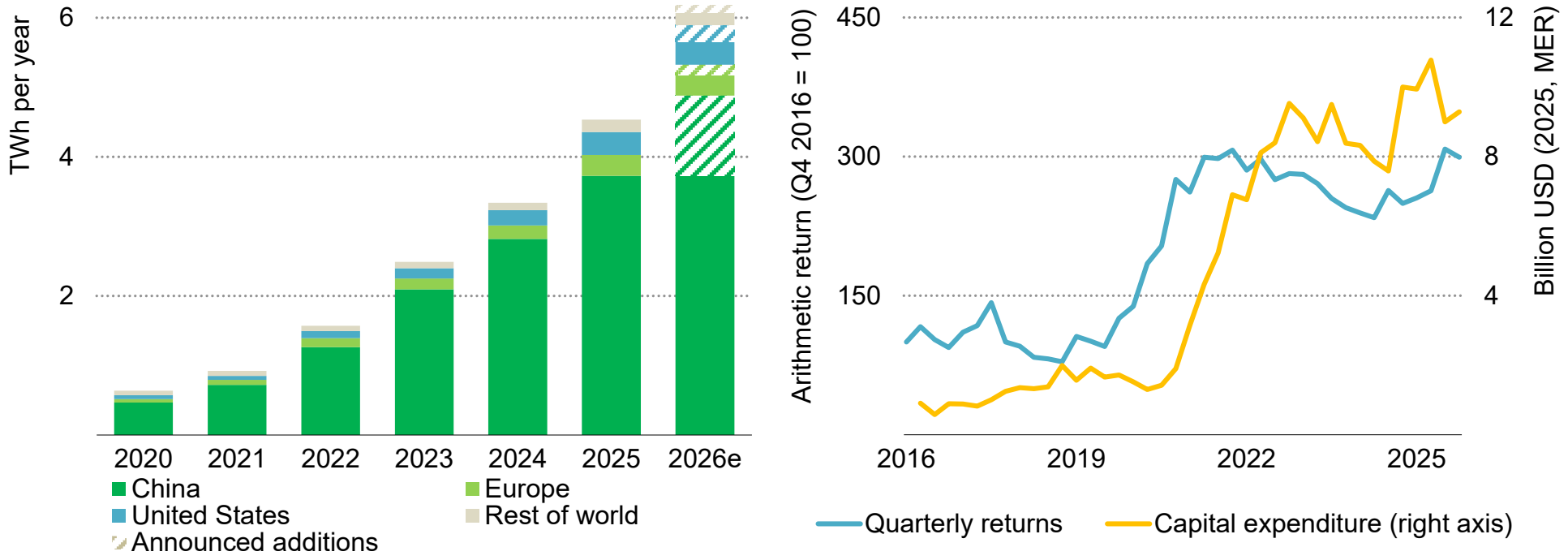
Financing conditions are becoming a more important determinant of EV uptake and investment. In markets where broad purchase subsidies are being reduced, the availability of loans, leasing and other affordability-oriented products can play a larger role in sustaining demand. Policy changes in 2025 were broadly consistent with this trend, including tax-based support for EV purchases in Spain, fleet-oriented fiscal incentives in Australia, rebates and heavy-vehicle incentives in Singapore, tax exemptions and fleet support in Uruguay, and a state-backed financing scheme for electric cars and minibuses in Chile. Financing options such as EV leasing can also boost adoption by lowering upfront costs, as illustrated by France's social leasing scheme.

In emerging market and developing economies, flexible debt, lease-to-own structures and battery-swapping-linked vehicle finance may be particularly important to improve affordability, especially for two- and three-wheelers and commercial fleets. The second-hand EV market may also become more prominent during periods of high fuel prices, when lower purchase costs and immediate availability can accelerate the switch away from internal combustion engine vehicles. Taken together, these developments suggest that future EV investment will depend not only on vehicle supply and charging infrastructure, but also on the expansion of financing models that reduce upfront costs.

These trends suggest that electrification spending should be interpreted as a function of both deployment volumes and technology costs. Higher spending may reflect rising sales of EVs and associated infrastructure as electrification scales up, even when unit costs and incremental cost premiums are falling. With electric cars now accounting for one-quarter of total vehicle sales globally, lower incremental spending on EVs could still coincide with continued market enlargement as the cost gap with internal combustion engine vehicles narrows. However, because EVs still represent a relatively small share of the global vehicle stock, rising expansion is likely to be the main driver of global EV investment growth for some time.

Owing to strong market returns, capital expenditures in the battery industry have reached around USD 10 billion

Battery manufacturing capacity, 2020-2026e (left) and financial indicators for listed battery companies, 2016-2025 (right)



Global battery manufacturing capacity hit 4.5 TWh in 2025, following a robust 36% increase. It is expected to climb above 6 TWh in 2026, assuming announced projects are completed as planned.

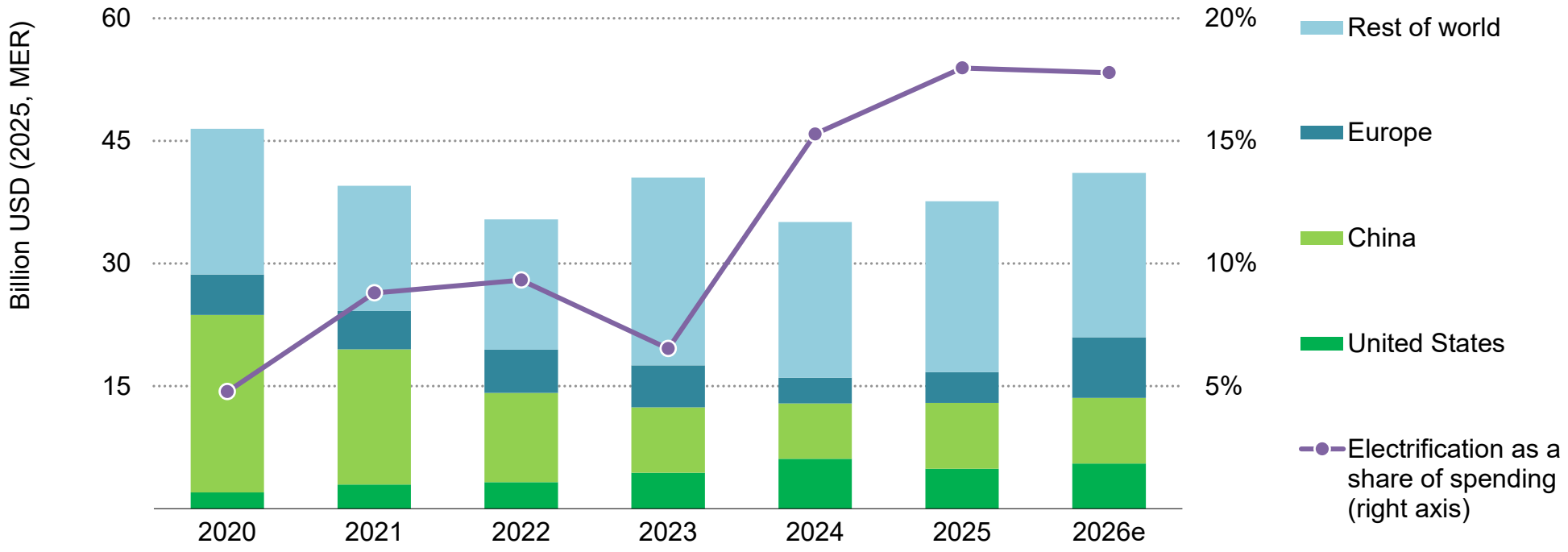
Notes: MER = market exchange rate. 2026e = estimated. Quarterly returns are based on the total return index of an equally weighted portfolio of listed battery companies. Listed battery companies are: LG Energy Solution; BYD; Contemporary Amperex Technology; Samsung SDI; Gotion High-tech; Eve Energy; and Farasis Energy Gan Zhou. Manufacturing capacity refers to battery cells. 2025 values are based on installed capacity. 2026 values reflect installed and committed capacity (solid bar) and preliminary announced manufacturing capacity (shaded bar).

Sources: IEA analysis based on data from Benchmark Mineral Intelligence (2026), Bloomberg Terminal (2026).

Industry

Energy efficiency investments in industry are likely to rebound in 2026, with electrification accounting for an important share of spending

Investment spending on energy efficiency and electrification in the industry sector by region, 2020-2026e



Industrial efficiency investments continue to grow in 2026, with Europe accounting for most of the increase, while absolute spending on electrification is rising across all regions.

Notes: MER = market exchange rate. 2026e = estimated.

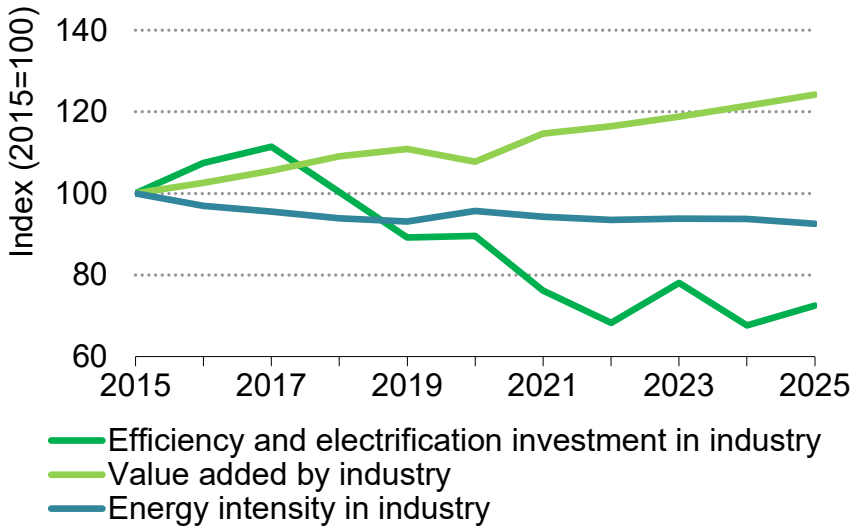
Despite expected rebounds in 2026, financing constraints continue to steer capital towards low-risk investments

Corporate decision-making is shaping industry investments in energy efficiency and electrification in 2026. Unlike other end-use sectors, over half of industrial investment is funded directly from firms' balance sheets or financed through corporate debt. As a result, financing conditions and commercial risk considerations remain the dominant filters for determining where capital will flow.

In all major industrial regions, high interest rates and margin pressures across heavy industry continue to reinforce a conservative investment environment. In China, persistent overcapacity and weak industrial price dynamics are restraining profits of industrial enterprises, limiting their appetite for larger capital commitments. The European Union – which has consistently supported industrial decarbonisation – is not exempted from this trend, with high and volatile electricity prices steering investment towards cost-reducing upgrades rather than capital-intensive transformation. In the United States, demand for heating and cooling equipment is weakening, reflected in the sharp year-on-year drop in central air conditioner and heat pump sales. Reductions in end-use demand feed through to the industrial base, affecting manufacturers and related supply chains.

These tightening financing conditions are tempering the willingness of firms to take on further risk by embarking on ambitious projects to structurally decarbonise their operations. In this context, industrial investment recovery does not translate into a comparable acceleration of deep decarbonisation. Most firms remain price takers in global commodity markets, with limited ability to pass through higher costs. At the same time, in several hard-to-abate sectors, low-emissions technologies are still not fully mature and continue to carry a meaningful cost premium. As a result, investment decisions tend to prioritise short payback periods, operational certainty and balance-sheet resilience, even as policy ambition continues to strengthen.

Energy and economic indicators in industry, 2015-2025



Diverging regional policy environments shape industry investments

Regional policy frameworks are increasingly determining the direction of industrial investment. While governments are strengthening carbon pricing, state aid and industrial strategies, the translation into realised investment remains limited because key risk parameters have not shifted sufficiently to trigger large-scale industrial transformation.

In the European Union, tightening carbon pricing, the phase-down of free allowances under the EU Emissions Trading System (ETS) and introduction of the Carbon Border Adjustment Mechanism have strengthened long-term incentives for industrial decarbonisation. Targeted support is also expanding through the Innovation Fund (one of several EU funding mechanisms supporting industrial decarbonisation), with the latest auctions attracting almost EUR 10 billion in bids from industry, including around EUR 1.4 billion in funding requests for industrial heat decarbonisation.

These auctions are part of a broader set of Innovation Fund instruments, accompanied by wider-ranging EU initiatives such as the Clean Industrial Deal and the Chemicals Action Plan, which together aim to mobilise over EUR 100 billion in support. However, high and volatile electricity prices, together with generally weak demand across sectors – particularly in construction, a key component of industrial activity – continue to weigh on final investment decisions, limiting the pace at which announced projects reach financial close.

In the United States, investment focuses primarily on cost competitiveness, energy affordability and reshoring. Recent legislative changes have particularly raised uncertainty about policy support for clean industrial projects. Changes under the One Big Beautiful Bill Act reduced incentives for clean hydrogen and industrial decarbonisation, weakening the business case for low-emissions technologies, in addition to previously awarded federal funding for industrial decarbonisation. Since the beginning of 2025, a total of 321 awards, representing USD 7.5 billion in federal funding for clean energy manufacturing, have been cancelled or terminated, with a broadly similar additional amount reportedly under review for potential termination. Recent developments across industrial value chains reflect these changes, with project cancellations (particularly in battery and EV manufacturing) valued at roughly USD 29 billion in 2025. While the recently introduced Industrial Accelerator Act represents a potential counterweight, its impact on investment flows remains to be seen.

In China, policy is shifting from expansion towards consolidation and upgrading to address persistent overcapacity, stagnating demand and weak profitability. Capacity controls, efficiency standards and support for greater scrap use are directing capital towards incremental efficiency improvements and electrification of existing assets.

In other emerging market and developing economies, industrial policy frameworks are evolving, with some governments setting out clearer directions for industrial decarbonisation, though many measures remain at the level of roadmaps and announcements rather than binding policy frameworks. Indonesia's Industrial Decarbonization Roadmap targets steel, cement and ammonia with measures to drive fuel switching; Viet Nam is piloting an ETS covering steel, cement and power; Malaysia's Steel Industry Roadmap 2035 promotes a shift towards direct reduced iron (DRI) and limits new blast furnace capacity.

However, the deployment of capital-intensive technologies remains dependent on concessional finance and external risk-sharing, rather than on domestic market signals alone. While many EMDE countries benefit from lower electricity costs than advanced economies, power supply is often coal-dependent, and integrating variable renewable electricity into industrial processes requires mechanisms to ensure stable and reliable supply – an additional barrier to electrification-led decarbonisation.

In Latin America, industrial decarbonisation policy remains at an early stage relative to the region's renewable energy buildout. Brazil is the most active market, though an ongoing multi-year tax reform (which began to take effect earlier this year) is generating transitional uncertainty at the federal, state and municipal levels. This is affecting tax classification and contract economics and may also delay projects and trigger contract renegotiations. More broadly, fragmented regulatory environments, limited monitoring and reporting capacity, and weak policy credibility constrain the deployment of low-carbon industrial solutions across the region.

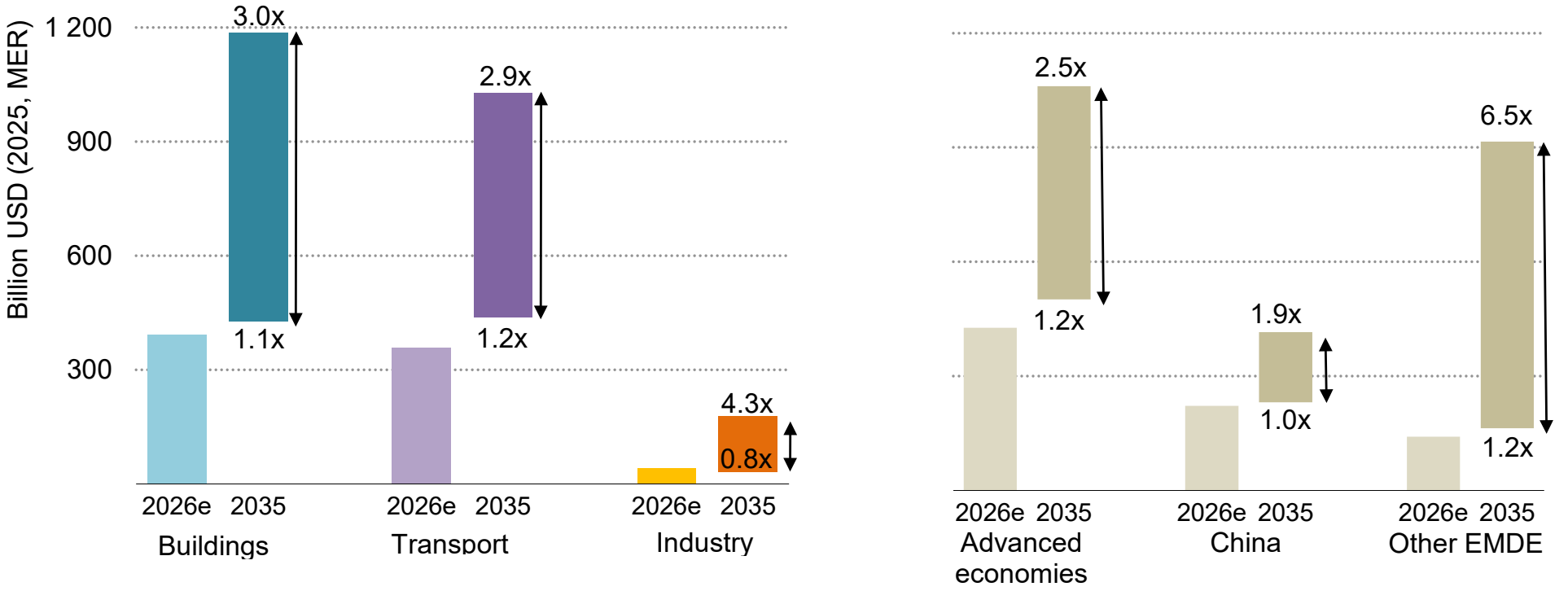
In Africa, Egypt and South Africa's recent inclusion in the Climate Investment Funds' USD 1-billion Industry Decarbonization Program – the first dedicated concessional fund for hard-to-abate sectors in middle-income countries – signals growing international attention to industrial transition pathways outside of advanced economies. While still at an early stage of development, the initiative reflects a broader shift towards mobilising blended finance and concessional capital to crowd in private investment for industrial decarbonisation in emerging market. However, the scale remains modest relative to the investment needed to transform emissions-intensive industrial bases.

Across both regions, as in other emerging markets, regional policy frameworks are improving visibility and expanding potential project pipelines. However, without stronger demand-side signals, lower clean-electricity costs and more effective mechanisms to mitigate risk, industrial investment is likely to remain concentrated in incremental upgrades rather than transformative decarbonisation.

Implications

Accelerating end-use investment is a strategic opportunity to lay the groundwork for a more efficient, secure and affordable energy system

End-use-sector investment by category (left) and region (right) in 2026e, and scenario ranges for 2035



Meeting future energy system objectives would require end-use investment to rise by a factor of one to three by 2035 in buildings and transport, and more than fourfold in industry. EMDE scale-up is particularly challenging relative to current investment levels.

Notes: MER = market exchange rate. EMDE = emerging market and developing economies. 2026e = estimated. Minimum and maximum 2035 investment values correspond to scenarios with different levels of ambition.

Energy security crises have repeatedly turned energy efficiency and electrification into foundations of resilience

Periods of geopolitical turmoil have a long history of reshaping how societies think about energy. Repeatedly, moments of disruption have revealed that energy security is not determined by supply alone, but by how much energy economies require in the first place, how flexibly it can be delivered and how exposed end-users are to fuel chokepoints. Historically, the most consequential shifts in energy efficiency and electrification have risen not from long-term planning in times of stability, but from crises that exposed structural vulnerability – and expanded what was politically and economically possible.

The oil shocks of the 1970s marked the first time energy became embedded in national security discourse. Before that, energy policy in advanced economies largely assumed abundant and reliable fossil fuel imports. The abrupt price spikes and shortages that followed the 1973 embargo and the 1979 oil crisis shattered this assumption, forcing governments to confront the risks of depending on globally traded fuels. Crucially, the policy response moved energy efficiency from the realm of voluntary conservation and public appeal into the domain of mandatory action. Building codes tightened, vehicle fuel-economy standards were introduced and industrial processes were restructured, not primarily to protect the climate, but to reduce vulnerability to external shocks.

The early response established a critical precedent. While short-term demand restraint helped manage emergencies, the most durable gains came from structural measures that permanently lowered energy intensity and reduced exposure to supply disruptions. Once implemented, these changes outlasted the crises themselves, continuing to deliver benefits even as prices stabilised. The lesson was clear: energy security is strengthened not only by finding new supplies, but by redesigning how energy is consumed.

The energy crisis of the 2020s has revived this logic under profoundly different technological conditions. The gas supply shock of 2021-22 and the renewed geopolitical disruptions of 2026 once again highlighted the vulnerabilities and interdependencies of global energy systems – particularly those reliant on imported fuels flowing through concentrated trade routes. Yet, unlike the 1970s, today's response is not limited to saving fuel. New technologies that enhance energy efficiency and boost electrification – using power increasingly generated from low-emissions sources – now offer a pathway to eliminate entire categories of exposure. In this context, technologies such as heat pumps, electric vehicles and electrified industrial heat are appreciated for their multiple benefits as instruments of energy security and system resilience.

This shift is especially visible in end-use sectors, in which energy security risks are ultimately felt most acutely. In buildings, the focus has evolved from reducing consumption through insulation alone to electrifying heating and cooking, lowering dependence on imported gas and oil. In industry, decades of exposure to volatile energy prices have already prompted significant declines in energy intensity; today, there is the option of using electrification of low- and medium-temperature heat as a strategic hedge against fuel price shocks and supply interruptions. In transport (historically the sector most exposed to oil market volatility), the objective has moved from improving fuel economy to a more complete switch away from reliance on oil through electrified mobility. In response to the surge in gasoline prices from the Middle East crisis in 2026, interest in EVs has escalated in many parts of the world, including the European Union, Australia and Viet Nam. Across all three sectors, crises have repeatedly acted as catalysts for more rapid structural change.

A key implication in this history is that energy security challenges are often misdiagnosed as purely supply-side problems. Strategic reserves, emergency imports and short-term market interventions are important during acute disruptions, but they do not address the underlying exposure of economies to volatile fuels. Energy efficiency and electrification alter this equation by reducing the scale of demand that must be met and by shifting consumption towards more controllable, domestically anchored energy carriers. While these measures take time to deploy and offer limited relief during a crisis, they critically shape the severity, duration and policy cost of future shocks. Sustained, predictable investment, rather than reactive shifts triggered by each disruption, reduces reliance on emergency measures and eases pressure on energy systems when stress materialises.

The current geopolitical context therefore presents us with a critical test. It reminds us that energy efficiency should not be viewed as a last-minute adjustment or a temporary call for restraint, but as a core component of a resilient energy system. Likewise, electrification is not only a vector for achieving environmental goals; especially for fuel-importing countries, it is a means of converting imported risk into domestic control. While electrification can entail new security-related challenges, it also creates lasting insulation from external shocks of the sort that we are seeing today.

The enduring lesson from half a century of energy disruptions is that the most secure unit of energy is the one that never needs to be imported, combusted or backed up under emergency conditions. Crises may trigger action, but resilience is built through lasting structural change. Past shocks did not reverse demand growth; instead, they reshaped how energy was used as economies expanded and diversified. Energy efficiency and electrification offer precisely that: not just a response to the stress of today's geopolitics, but a foundation for a more stable, secure and resilient energy future. The investment scale described in this chapter therefore represents not a stretch goal, but a measure of how structural resilience must be built into the systems that underpin our daily economic life.

R&D and clean technology manufacturing

Overview

Governments and corporations are increasingly recognising the importance of R&D spending, though energy-related venture capital investment has continued to fall from the highs of 2022

Spending on energy innovation and on clean technology manufacturing (the latter included for the first time in this edition of the World Energy Investment) is counted separately from our overall energy investment numbers, but nonetheless represent important parts of the overall picture. A range of factors stimulates spending on energy innovation: for companies it is an opportunity to maintain competitiveness, expand to new markets and develop new intellectual property; for venture capital (VC) funds, financing early-stage companies holds the potential of high growth and returns; and for governments, it can drive growth, develop new industries and reduce reliance on imports and foreign supply chains.

Growth in public energy research & development (R&D) has fallen slightly following eight years of sustained growth, down from a high of USD 53 billion in 2024 to USD 49 billion in 2025 (equivalent to 12% of direct government spending on energy). Reductions in spending can be partly explained by funding cuts in the US and year-on-year variability in EU budget allocations. Rising public expenditures on defence may also have placed pressure on R&D budgets (though some defence funding does go towards energy innovation, for example the US Janus Program to develop small modular reactors).

Public spending as a share of GDP has declined notably since the 1980s, when it rose to 0.1% of GDP in IEA member countries in response to energy security concerns of the 1970s oil crisis. While there have been no signs yet of a boost to public R&D following disruption from the conflict in the Middle East – with countries prioritising emergency support, as trackd in the IEA Energy Crisis Policy Response Tracker – a prolonged period of high fossil prices could encourage rapid growth in public energy R&D.

R&D expenditures by corporations operating in energy-related sectors have continued to grow consistently over the last decade, though year-on-year growth in 2025 slowed to the lowest since our tracking in the WEI series. Declining economic growth, pressure on revenues, rising trade policy uncertainty and the feedthrough of higher interest rates may all have contributed to corporate R&D funding reductions. In fact, corporate R&D spending for most energy-related sectors remains highly concentrated, with a small number of automotive manufacturers, energy infrastructure providers and heavy industry making up almost all of the ten largest R&D spenders.

VC funding is also key for the scaleup of innovations, offering financing but also strategic advice, network access and operational support. However, total VC funding for energy-related start-ups fell for the third consecutive year in 2025, with early indicators that the reduction is likely to be sustained in 2026. While a range of factors is

responsible, one major one is that VC capital is largely focused on the pursuit of high returns, rather than on support for specific sectors. During previous periods of low interest rates and stronger policy focus on clean energy, VC flows towards energy technologies rose, but still-high interest rates from 2022 and rapidly growing interest in artificial intelligence (AI) have since reduced energy VC flows.

Most direct public energy-related R&D expenditures tracked by the IEA are grants-based, with only limited data on concessional debt allocations and tax breaks. To incentivise corporate R&D spending, many governments provide preferential tax treatment for company R&D expenses. In OECD and EU countries, indirect expenditures through tax credits account for more than half of total public R&D support, exceeding direct funding. These fiscal R&D incentives are typically sector-neutral, though some examples are designed to encourage R&D for clean energy and related technologies. For example, R&D tax credits in South Korea reach 25% (depending on company size) but rise to 50% for “nationally strategic technologies” including hydrogen, secondary batteries and future mobility.

The increased focus on energy R&D is just one part of the “industrial policy”-based approaches that governments are adopting to navigate a range of policy goals. R&D spending and fiscal incentives to drive energy innovation sit alongside measures to attract foreign direct investment and grow strategic industries. Innovation policy levers extend beyond direct R&D spending, with increasing interest in “demand-creation” policies such as public procurement and regulatory standards that can induce innovation through competition and widen product offerings. For example, the number of energy performance regulations has nearly doubled since 2010, while measures such as carbon pricing (which has also been growing in coverage) can incentivise technology-neutral innovation by focusing on outcomes (i.e. emissions reductions). Evidence for the effectiveness of existing carbon pricing schemes on innovation has been more limited, due to lower prices and predictability, though some schemes have served as a source of revenue for direct R&D spending (e.g., the EU ETS and Innovation Fund).

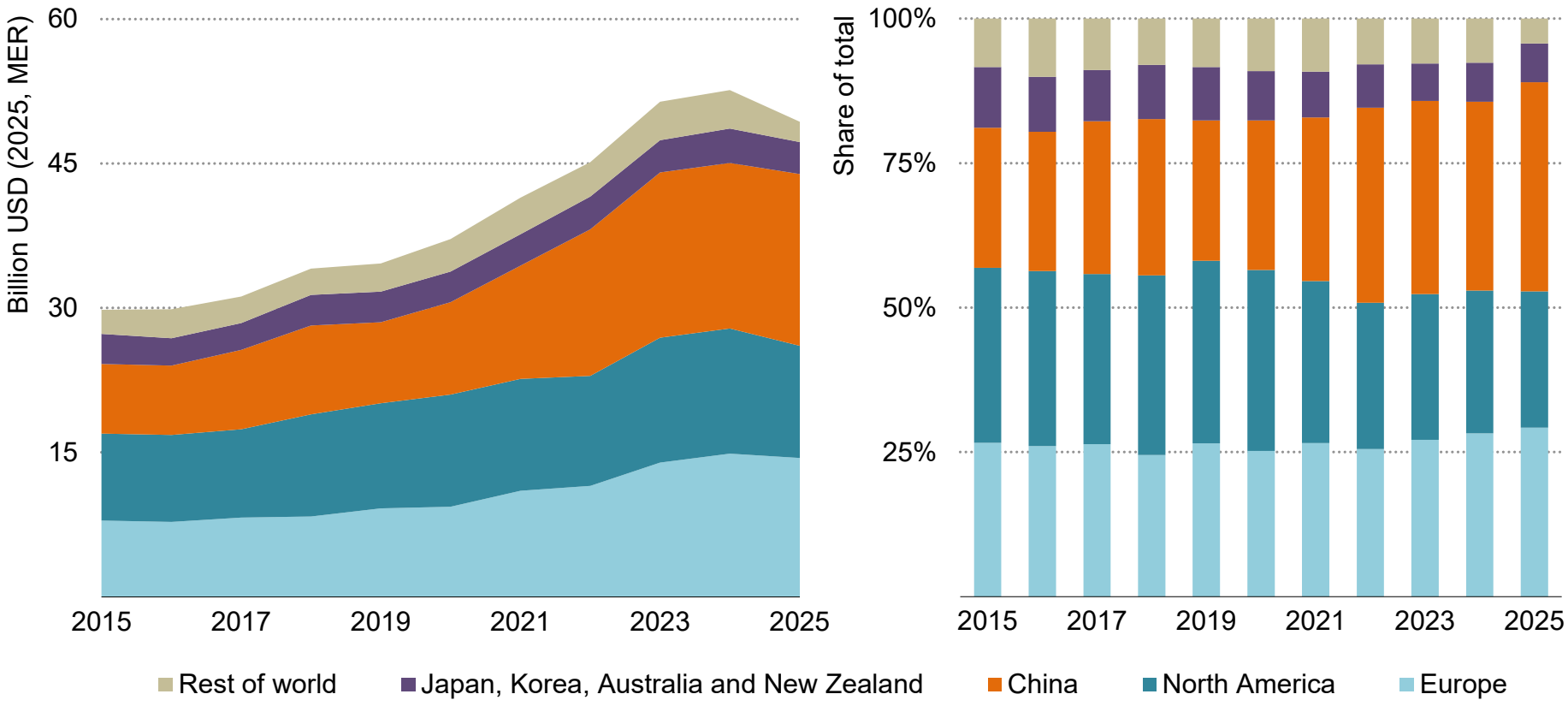
Targeted public energy R&D spending, both direct and indirect, is just one of many ways some governments are developing their industrial policies to develop supportive ecosystems for innovation and subsequent investment. Motivated by energy security concerns and growing demand for clean energy technologies, governments are exploring how to align their energy R&D priorities with strategic manufacturing segments, aiming to create competitive advantages through new technologies and manufacturing approaches.

For the first time since the inception of World Energy Investment, we present trends in clean energy technology manufacturing investments, which rose to nearly USD 200 billion in 2025 for batteries, electric vehicles (EVs) and renewable energy technologies (also counted separately from the USD 3.3 trillion of energy project investment in 2025). We also briefly discuss two examples of interactions between energy innovation and domestic supply chains: solar supply chains in China, and wind manufacturing in Denmark.

Public energy R&D spending

Government spending on energy R&D dipped in 2025

Public spending on energy-related R&D, 2015-2025

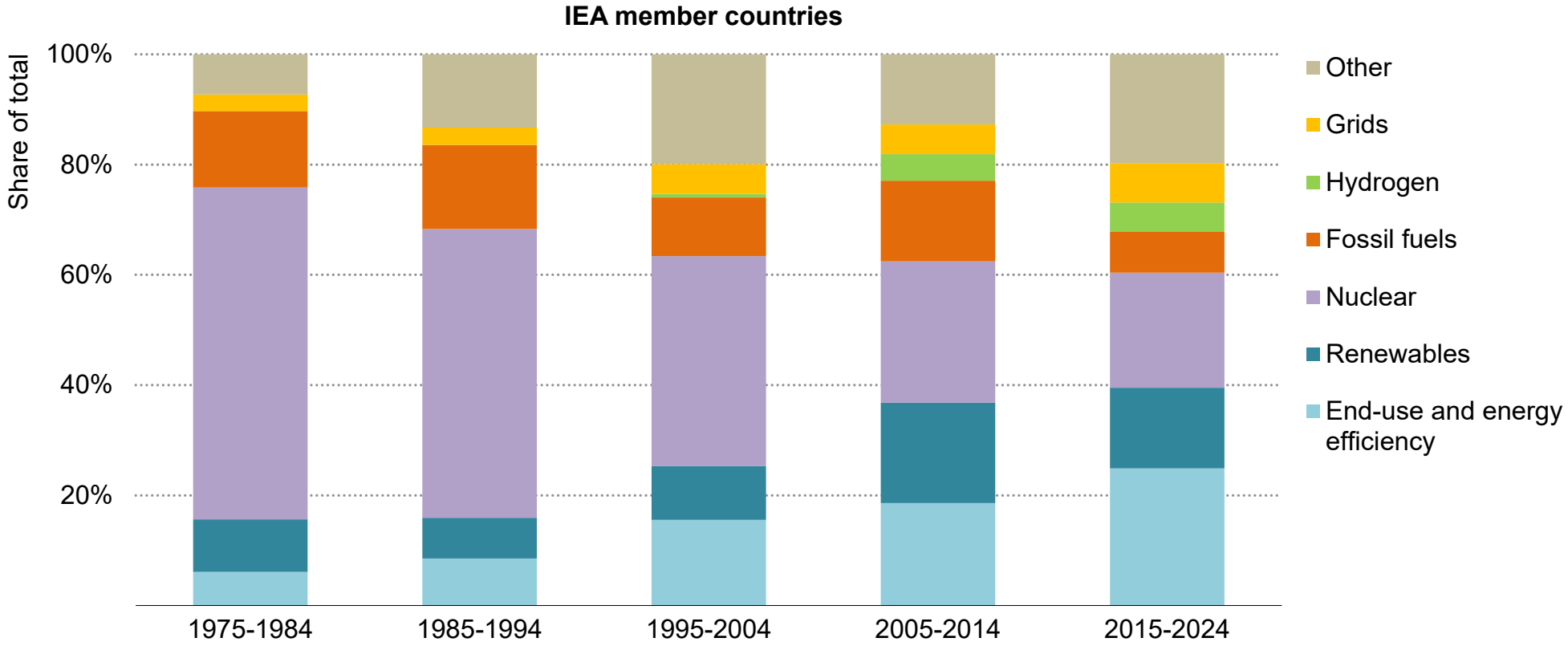


Reductions from major spenders including North America and a plateau in Europe caused total public energy-related R&D to fall in 2025.

Notes: MER = market exchange rates. The European Commission's submission does not account for all 2024 and 2025 programmes, so actual trends may differ.
Source: IEA (2026), Energy Technology RD&D Budgets.

The focus of government spending on energy-related R&D has changed over time

Public spending on energy-related R&D, average shares by technology for IEA member countries, 1975-2024

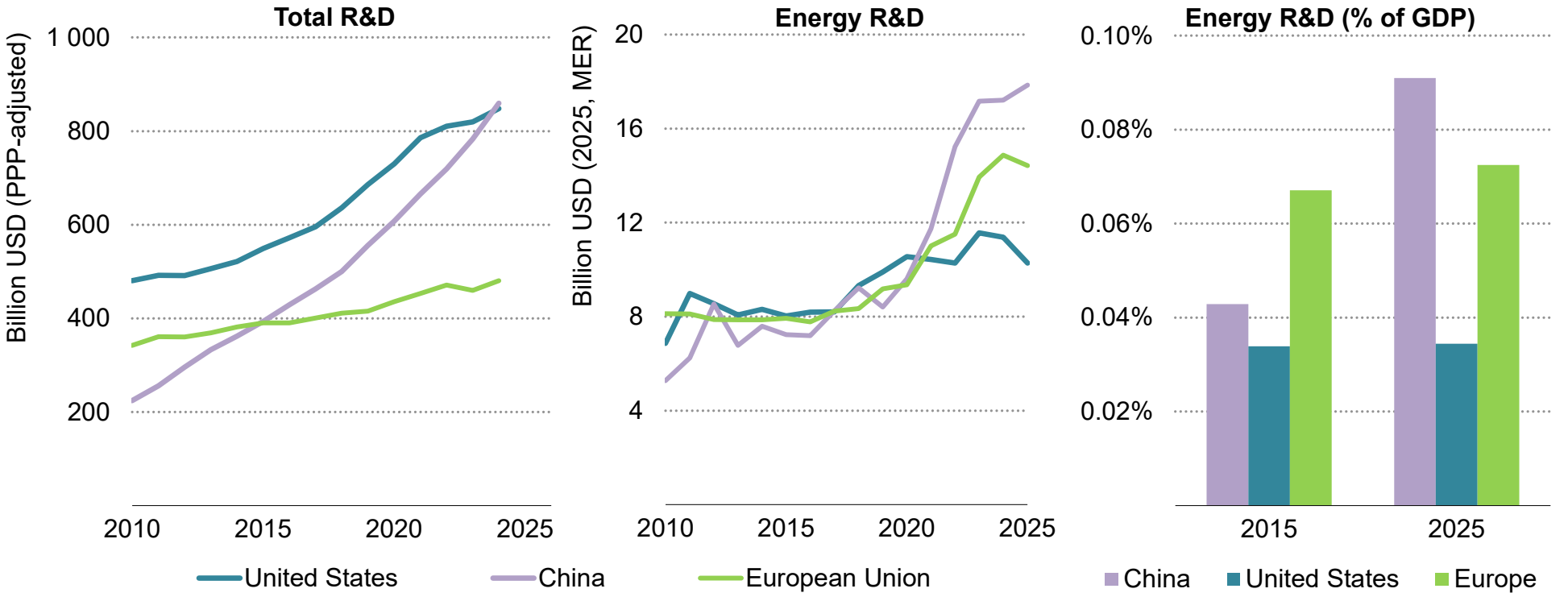


The focus of public energy R&D spending has shifted over time, with nuclear and fossil fuel shares shrinking in IEA member countries.

Source: IEA (2026), Energy Technology RD&D Budgets.

Competition in R&D and technology innovation efforts is rising, including in energy

Evolution of public R&D spending for China, the United States and the European Union, 2010-2025



Public energy R&D spending in China, the US and the European Union have all increased, though the largest rise has been in China.

Notes: PPP = purchasing power parity. MER = market exchange rate. The left plot compares total public R&D spending in PPP terms to compare the domestic purchasing power of R&D budgets across countries and to be consistent with the underlying source data, whilst MER is used to compare for energy R&D in line with IEA reporting standards. The European Commission's submission does not account for all 2024 and 2025 programme spending, so actual trends may differ.

Source: IEA (2026), Energy Technology RD&D Budgets.

Public energy-related R&D spending declined in 2025 due to reductions from key spenders, with a growing number of competing fiscal priorities set to test future energy R&D budgets

Annual spending on energy-related R&D by national governments fell in 2025, following eight years of sustained growth at rates often exceeding global economic growth. Early indications show that spending may continue to fall in 2026, though the impacts of the conflict in the Middle East may induce greater public energy R&D to boost energy security. For example, the crisis in 2022 caused by Russia's full-scale invasion of Ukraine was a driving factor for domestic government spending to double from USD 200 billion in 2020 to USD 400 billion in 2025, while the earlier oil crisis of the 1970s boosted energy R&D.

Declines in public energy R&D expenditures globally stemmed largely from dips in annual spending in North America and a plateau in Europe, following years of steady growth since 2015. For Europe, plateauing may be a result of the nuances in the EU budgetary process - i.e. demonstration funding distributed through the EU Innovation Fund in recent years has been retrospectively allocated once final agreements have been signed, making current years lower but previous years higher. Thus, future reporting of EU funding may push reported values for 2024 and 2025 upwards. Meanwhile, the drop in North America was mainly due to drops in US federal R&D funding for energy during a period of reprioritisation that may lead to more military and defence R&D and a focus on different energy fields.

Public energy R&D as a share of GDP across all IEA member states is still far below the 0.1% reached in the 1980s, when the oil crisis prompted countries to raise funding for energy innovation. Global public energy R&D spending is also more widely distributed than in the 1980s, with China now accounting for over one-third of spending in 2025 in addition to growth in other emerging markets and developing economies. Chinese and US total public R&D expenditures are similar (in PPP-adjusted terms), though China and the European Union both spend more on energy R&D (in absolute and as a share of GDP) than the United States.

As a share of GDP, EU member states spend the most on energy-related R&D. From 2022 to 2025, Spain, France, Belgium and Austria each spent more than 0.1% of their GDP on public energy R&D on average, with France and Spain collectively accounting for 10% of global public energy R&D spending. While end uses and energy efficiency have grown to account for the largest share of R&D spending in IEA economies (over a quarter on average), the distribution of energy R&D by technology varies markedly by country, depending on national priorities. For example, nuclear is the primary area of energy R&D spending in France (indicating the role of nuclear in power generation), while Spain emphasises energy efficiency and end-uses (reflecting its energy strategy's "efficiency first" principles).

Of the countries tracked, fossil fuels are the largest area of energy R&D spending in only Mexico and Brazil – reflecting their position as oil producers – but overall R&D expenditures on fossil fuels have fallen to nearly the lowest share of total R&D ever, at an average of 5.7% in 2024. In over two-thirds of the countries, renewable energy is in the top three main R&D spending areas by technology, while fossil fuels are in the top three for seven economies only.

In recent years, public R&D spending on electricity grids reached the highest level to date, reflecting their importance in enabling renewable energy integration, power system flexibility, system stability and end-use electrification. Innovative grid technologies (e.g. distributed sensors for grid monitoring) can play an important role in reducing losses, increasing security and maximising capacity. Hydrogen and fuel cell R&D spending also reached its highest share ever, largely owing to spending by countries exploring hydrogen exports (e.g. Chile) and end uses (e.g. industry in Germany).

In the IEA RD&D Budgets database, tracking of direct public spending on energy-related R&D covers mostly covers grant funding. Data on the allocation of concessional debt and tax breaks for energy innovation are scarce. For the latter, EU and OECD data show that indirect tax incentives account for more than half of total (direct and tax-related) government support for business R&D on average, representing a key private R&D innovation support policy. In China, indirect tax support was equivalent to nearly five times direct R&D expenditures across all technology areas in 2023, exceeding OECD averages when measured as a share of GDP.

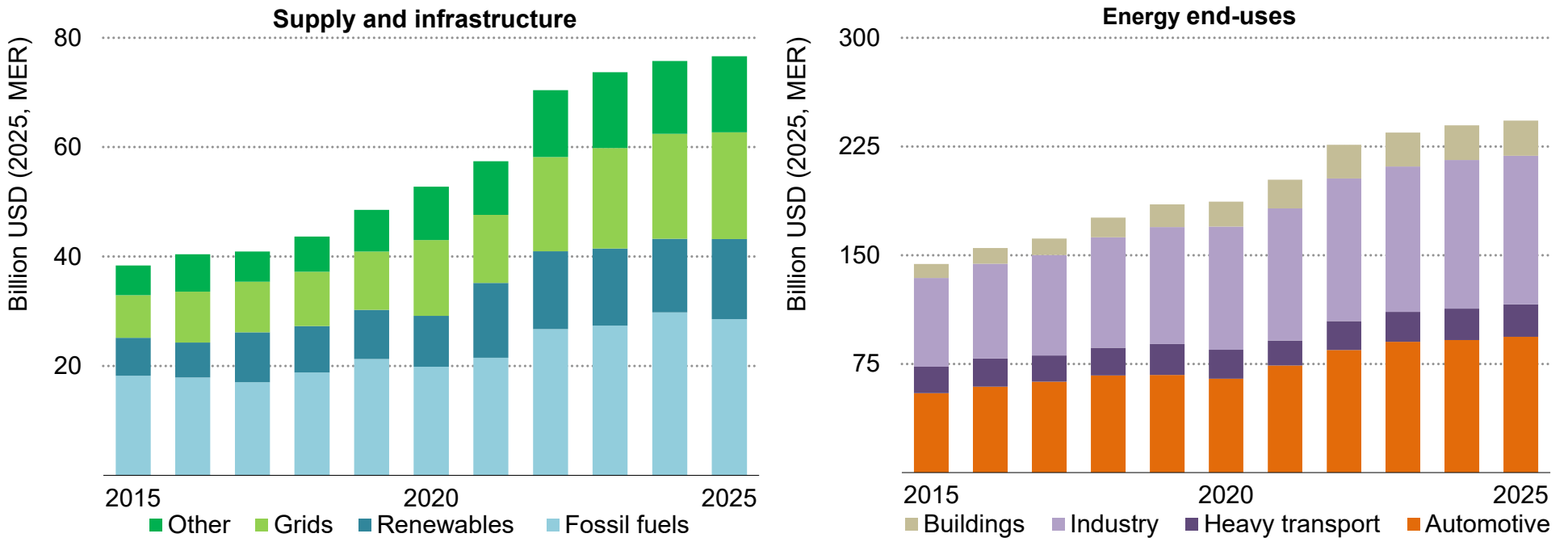
Tax incentives for R&D spending are generally available to all eligible businesses regardless of sector, but in several instances sector-specific tax rates are being used to incentivise energy-related R&D. In South Korea, for example, technologies designated as nationally strategic (including EVs, hydrogen and secondary batteries) receive a larger R&D tax credit than general R&D (up to 50%, compared with 25%). Belgium similarly provides an additional deduction for qualifying investments in assets used to support R&D for "environmentally friendly" products, including energy efficiency, while Japan provides a 40% R&D tax credit for expenses related to fusion energy and selected industrial technologies (e.g. AI).

Conflicting pressures in national budgets, including potential tightening of monetary policy and the need for national support schemes, may further constrain public energy R&D funding in 2026. Competing priorities for public R&D for other sectors – including AI and defence – may have also led to a reorientation of R&D on energy and environment with a proposal to increase the US R&D spending on defence by 23% in 2025-2026. R&D spending on defence in the European Union has also more than doubled since 2020, reaching USD 17 billion in 2025, while public energy R&D plateaued in recent years following the increase partly triggered by the energy crisis in 2022 caused by Russia's full-scale invasion of Ukraine.

Private R&D spending by corporate and venture capital investors

Corporate R&D in energy-related sectors grew at its slowest rate since tracking began

R&D spending by companies operating in energy-related sectors, by sector, 2015-2025



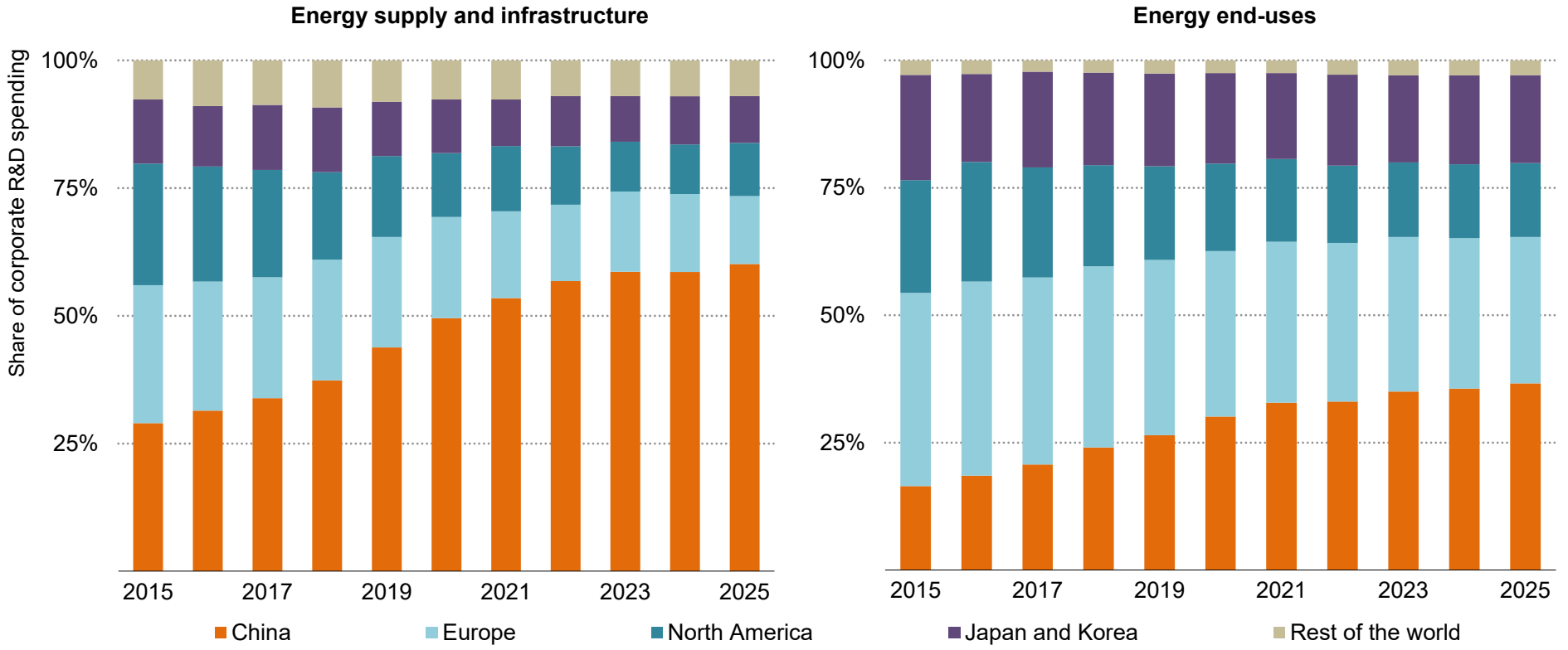
R&D spending by companies in energy-related sectors has continued to rise, though it slowed in 2025 to less than 2% growth.

Notes: MER = market exchange rate. Includes only publicly reported R&D expenditures by companies active in sectors dependent on energy technologies, including energy efficiency technologies when possible, based on the Bloomberg Industry Classification System. “Automotive” includes technologies for fuel economy, alternative fuels and alternative drivetrains. To allocate R&D spending by companies active in multiple sectors, shares of revenue per sector are used in the absence of other information. Values may include both capitalised and non-capitalised costs, including for product development.

Source: IEA analysis based on data from Bloomberg (2026), accessed on 13 May 2026.

China increasingly drives corporate R&D spending in energy-related sectors

R&D spending by companies operating in energy-related sectors by location, 2015-2025

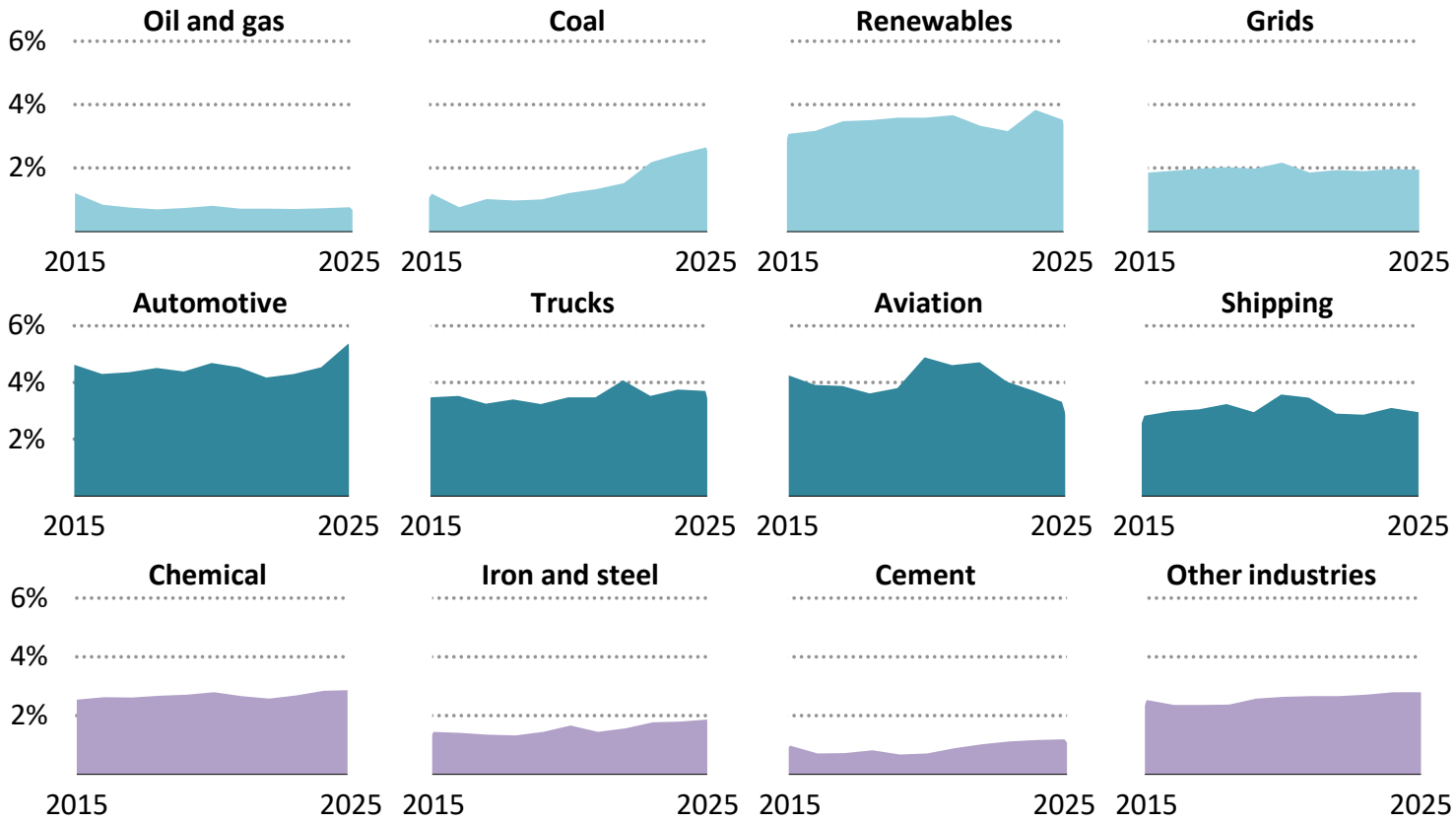


Chinese companies accounted for 42% of corporate R&D across energy-related sectors in 2025, more than double its share in 2015.

Source: IEA analysis based on data from Bloomberg (2026).

Renewable energy firms and companies operating in transport sectors spend the largest proportion of their revenues on R&D

R&D spending relative to revenues by companies operating in energy-related sectors, by subsector, 2015-2025



Companies operating in the renewables sector spend some of the largest proportions of their revenues on R&D, while hard-to-abate industries spend some of the lowest ratios of all energy-related sectors.

Source: IEA analysis based on data from Bloomberg (2026).

Corporate R&D by companies operating in energy-related sectors has continued to grow

Competition drives corporate R&D spending, which aims to reduce costs, improve products and processes, and expand into emerging areas. Companies operating in energy supply and infrastructure sectors spent over USD 75 billion on R&D in 2025, whilst energy-related R&D spend by companies operating in end-use sectors was estimated to reach nearly USD 250 billion. These figures for 2025, represent the smallest year-on-year increase since tracking started in 2010 (including 2020, when the pandemic impeded many R&D activities). In both cases, year-on-year growth was below 1.5%.

R&D expenditures by companies operating in energy supply and infrastructure grew slightly in 2025 to reach USD 77 billion, with growth largely led by companies developing and deploying renewables and grids. R&D spending by oil and gas companies fell for the first time since the global pandemic, decreasing 4%. As corporate R&D spending trends are typically linked to changes in revenue, this drop could reflect declining returns amid falls in fossil fuel prices globally during 2024 and 2025 (before the impacts of the conflict in the Middle East on global energy markets). The persistently high cost of capital in recent years may have also put pressure on cash positions across sectors, driving reductions in corporate R&D.

In 2025, R&D spending by corporations operating in grids and transmission reached USD 20 billion – the highest level since the IEA began tracking corporate R&D – because decarbonisation, electrification and digitalisation pressures, in addition to evolving requirements for grid infrastructure technology manufacturers, have driven rapid increases in grid investment. The largest R&D spenders in the grids sector in recent years are China's State Grid Corporation (averaging 16% of sectoral R&D spending) and Schneider Electric (10%). Company strategies and targets indicates that corporate R&D spending on grids is likely to continue to increase, with Schneider Electric aiming to spend 7% of its revenues on R&D by 2030.

Corporate R&D spending by companies operating in end-use sectors increased to USD 243 billion in 2025. Initial reporting shows that R&D spending in the automotive sector – which contributed to nearly 40% of corporate R&D in energy end-use sectors in 2025 – is likely to continue rising, with substantial increases from EV manufacturers such as Tesla (42% year-on-year) and BYD (17% year-on-year) outweighing cutbacks by European automotive manufacturers (e.g. BMW and Volkswagen) as part of cost reductions which may have been a consequence of the increased trade policy uncertainty throughout 2025.

Among all automotive manufacturers, R&D spending is focused on energy efficiency and electrification, accounting for an estimated USD 94 billion in 2025 (with an additional USD 140 billion earmarked for product development and other non-energy innovation areas not counted). R&D spending by companies operating in other end-use sectors has largely remained flat in recent years and is focused

mainly on product development, though publicly available data on the breakdown of R&D spending is more limited than for automotive.

Corporate R&D spending as a share of revenues in 2025 remains highest for companies operating in the renewables and transport sectors. For automotive and truck manufacturers, this is largely the result of competitive pressures, emissions standards and the development of EV product offerings. For renewables, rising demand and further technological opportunities are prompting more intense R&D. In contrast, technologies in industries such as cement, iron, and oil and gas often have longer gestation periods or rely heavily on established technologies. Companies in these sectors spend a smaller share of their revenues on R&D, with firms typically choosing to buy proven technologies than funding more "risky" internal research. An exception is the coal sector, in which the R&D intensity of Chinese companies has grown in recent years, likely influenced by the increasing coverage of "green mine" standards for mining sites as well as greater emphasis on CCUS for coal power and industry, to reinforce energy security and meet emissions targets.

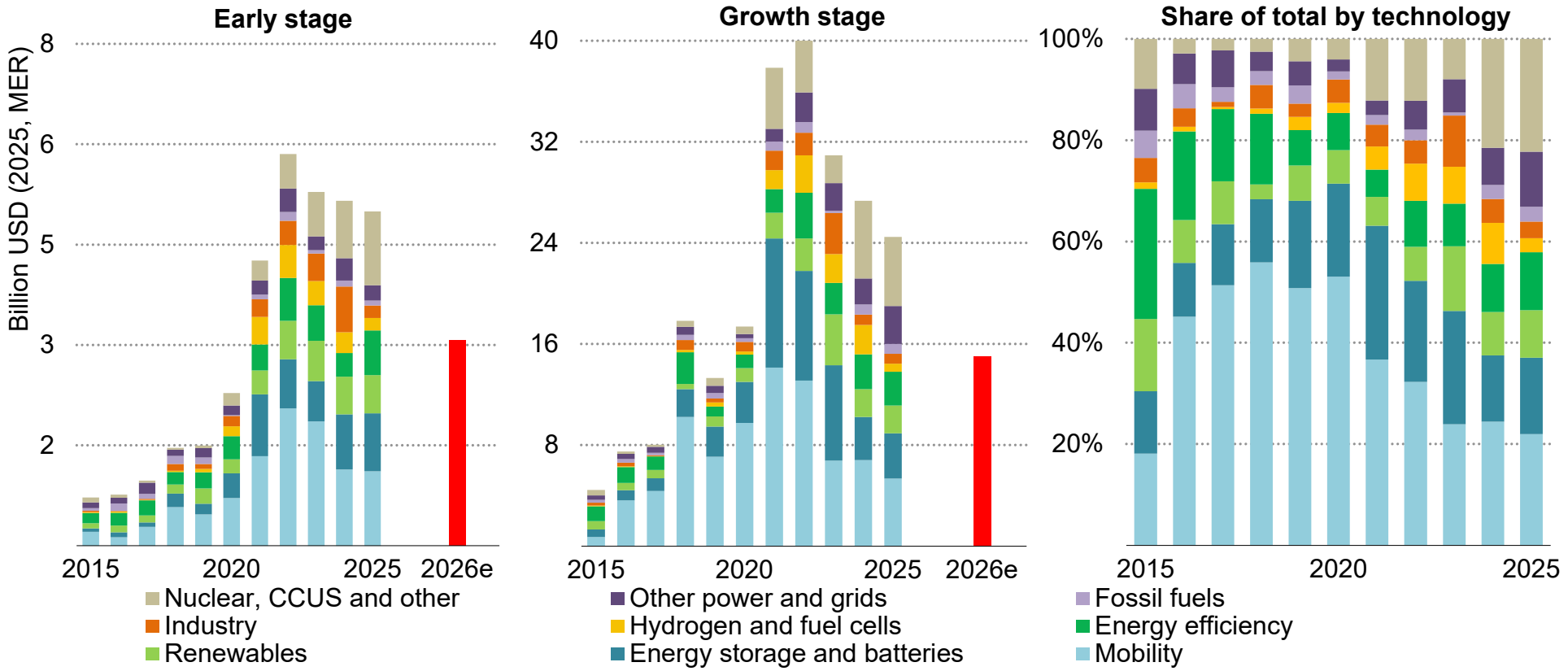
Corporate energy-related R&D spending is concentrated among a small number of companies, a trend also evident in global R&D spending across other sectors. For the coal, hydrogen, nuclear, grids, and oil and gas sectors, fewer than 20 companies represent 80% of R&D spending. For renewables, spending is more distributed, with 50 companies sharing 80% of R&D spending.

Over the past ten years China's corporate R&D spending in energy-related sectors has risen to account for 41% of the global total, up from 19% in 2015. For energy and supply infrastructure sectors, the share from Chinese companies reached up to 60% in 2025, with the largest single R&D spenders including the Power Construction Corporation of China (USD 3.8 billion), PetroChina (USD 2.8 million) and the State Grid Corporation of China (USD 3.1 billion). Schneider Electric was the largest corporate R&D spender of Western-domiciled firms operating in energy supply sectors, with R&D spending of USD 2.2 billion in 2025. For energy end uses – for which China accounts for a lower 37% of all corporate energy R&D – the largest corporate R&D spenders are headquartered in Germany (Bayer, Volkswagen and Mercedes-Benz), France (Airbus), the United States (General Motors) and the Netherlands (Stellantis).

China's strong economic growth in the last decade as well as its R&D "super deduction" corporate tax scheme (which expanded from 150% in 1996 to 200% in 2021) have boosted R&D spending by Chinese companies. Outside of China, corporate R&D spending in end-use sectors has risen just 25% since 2015, while R&D spending in energy supply sectors has risen just 12%. In both public and corporate funding, growth in energy R&D is increasingly driven by China, which became the country with the largest number of energy technology patent applications in 2021 (overtaking the United States).

Venture capital investments in energy-related start-ups declined for the third straight year

Venture capital investments in energy start-ups by technology area, for early- and growth-stage deals, 2015-2026



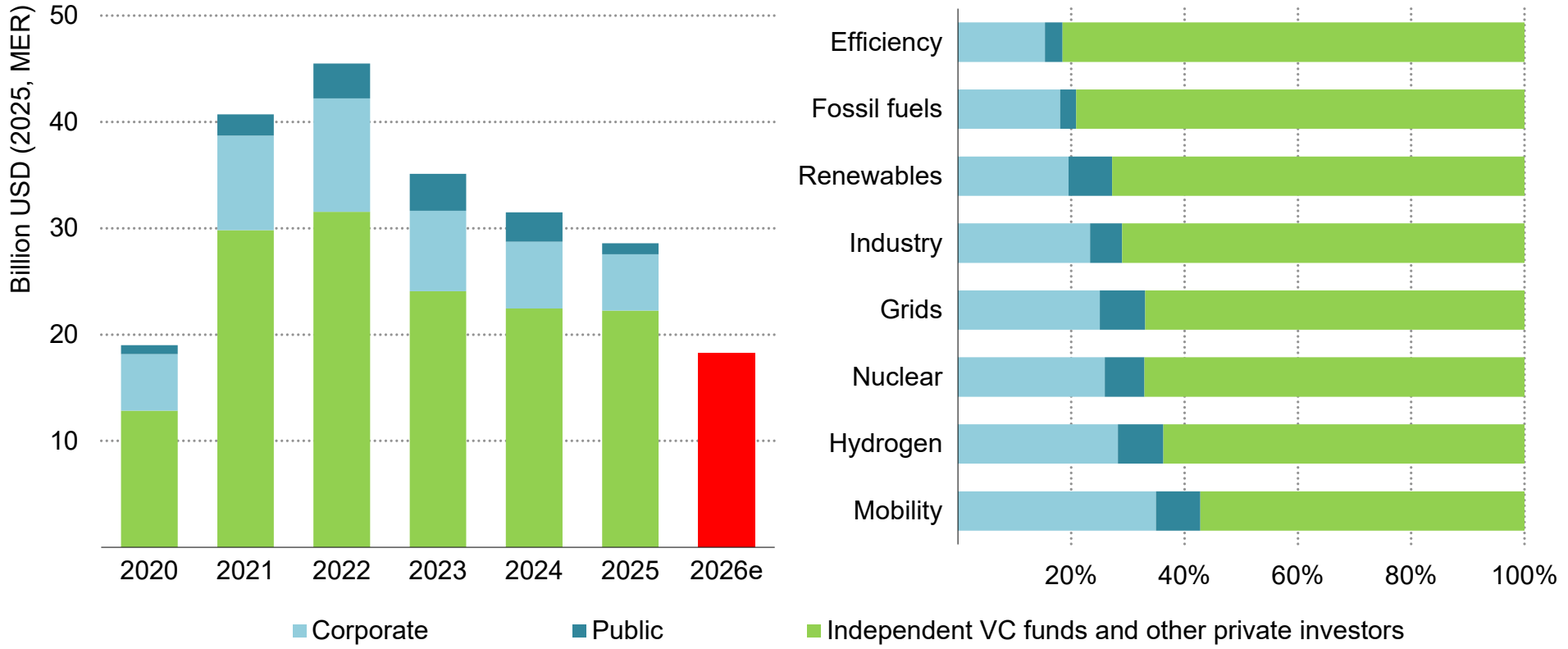
Both early- and growth-stage VC investments in energy start-ups fell again in 2025, though some technology areas were more resistant.

Notes: MER = market exchange rate. CCUS = carbon capture, utilisation and storage. 2026e = estimated. "Other" includes carbon dioxide removal (CDR), critical minerals and heat generation. Fossil fuels cover start-ups which aim to make fossil fuel production and use more efficient or less polluting.

Source: IEA analysis based on data from Cleantech Group (2025) and Crunchbase (2025). All databases were accessed on 31 April 2026.

Public and corporate venture capital investors have not closed the gap left by private funding

Total venture capital (VC) investment in energy-related start-ups, 2010-2026e



Energy-related VC funding from private investors has fallen significantly, with strategic investors not stepping up to close the gap.

Note: MER = market exchange rate. 2026e = estimated.

Source: IEA analysis based on data from Cleantech Group (2025) and Crunchbase (2025).

Venture capital investments in energy-related start-ups have declined in all technology categories, most notably mobility, which has made up a large portion of growth since 2015

VC funding for energy-related start-ups is important to scale up innovations, develop prototypes, fund demonstration projects and explore the practicalities of industry applications. Although energy VC has risen substantially since 2015, funding declined for three years after 2022, dropping to USD 28.5 billion in 2025 (the lowest level since 2020). Early reporting from Q1 2026 indicate that it is set to fall again in 2016 to USD 18 billion. While VC funding has dropped 40% since 2022 for growth-stage deals, it has been more resilient for early-stage deals (a decrease of 15% on 2022 levels).

In 2025, investments in AI-related start-ups dominated the VC funding landscape, accounting for around one-third of total deal value, with investments more than doubling from 2024. VC funding for start-ups in defence has also increased markedly in recent years, buoyed by rising public expenditures on defence and associated attention to defence and security innovations. Growing interest in these two subsectors may also be a factor in reduced VC flows into energy-related start-ups, as VC investors are seeking higher potential returns and technology areas at the peak of their VC funding cycle. There is some evidence that larger VC investors previously investing in energy have shifted funds towards AI, in response to changing market conditions and the recognition of AI as a strategic technology by many governments and businesses.

In the past decade, VC investments in start-ups working on EVs and mobility-related technologies accounted for nearly 35% of total VC energy-related spending. However, investments in mobility have fallen by almost 60% from highs of USD 15 billion in 2021 to USD 6 billion in 2025, indicating the end of an EV funding cycle due to the development and consolidation of an established EV industry globally. As leading EV manufacturers have secured market share, barriers to new entrants have increased, leading to VC investors allocating less capital to mobility start-ups. By contrast, R&D efforts by corporate incumbents such as BYD and Tesla have risen.

Although overall VC for non-mobility sectors has also decreased in the past three years, the effect is much less pronounced. When VC for mobility is excluded, the overall lower energy VC is closer to a plateau at 2021 levels, with some year-on-year fluctuations. Other technologies that appear to have followed a similar VC cycle are solar PV and hydrogen, with activity having fallen notably since earlier periods of stronger interest.

As EV and mobility start-ups reach the end of a VC cycle of interest, growing investor enthusiasm for other technology areas has partly offset the decrease in VC for mobility. Geothermal, aviation, critical minerals, carbon removal, heavy industry and nuclear power (both fusion and fission) claimed less than 5% of total VC funding between 2015-2025 but now account for more than one-third, with over

400 start-ups in these areas receiving support. Funding for critical minerals reached a record high, with KoBold Metals raising USD 535 million and GeologicaAI USD 44 million. Both companies aim to apply AI to satellite and geological imaging to accelerate early exploration.

Interest in fusion energy has also grown, with VC funding reaching USD 2 billion in 2025. Given the high capital requirements of nuclear fusion projects, deals can be large even though the technology is at an early stage of development. The largest deals in 2025 were in the United States: Commonwealth Fusion Systems (USD 863 million for a magnetic confinement demonstration project for the early 2030s) and Helion Energy (USD 425 million for a magneto-inertial confinement demonstration project aiming to operate by 2028). Several countries, including Japan and South Korea, define the technology as strategically important and are offering fiscal incentives for nuclear fusion R&D efforts.

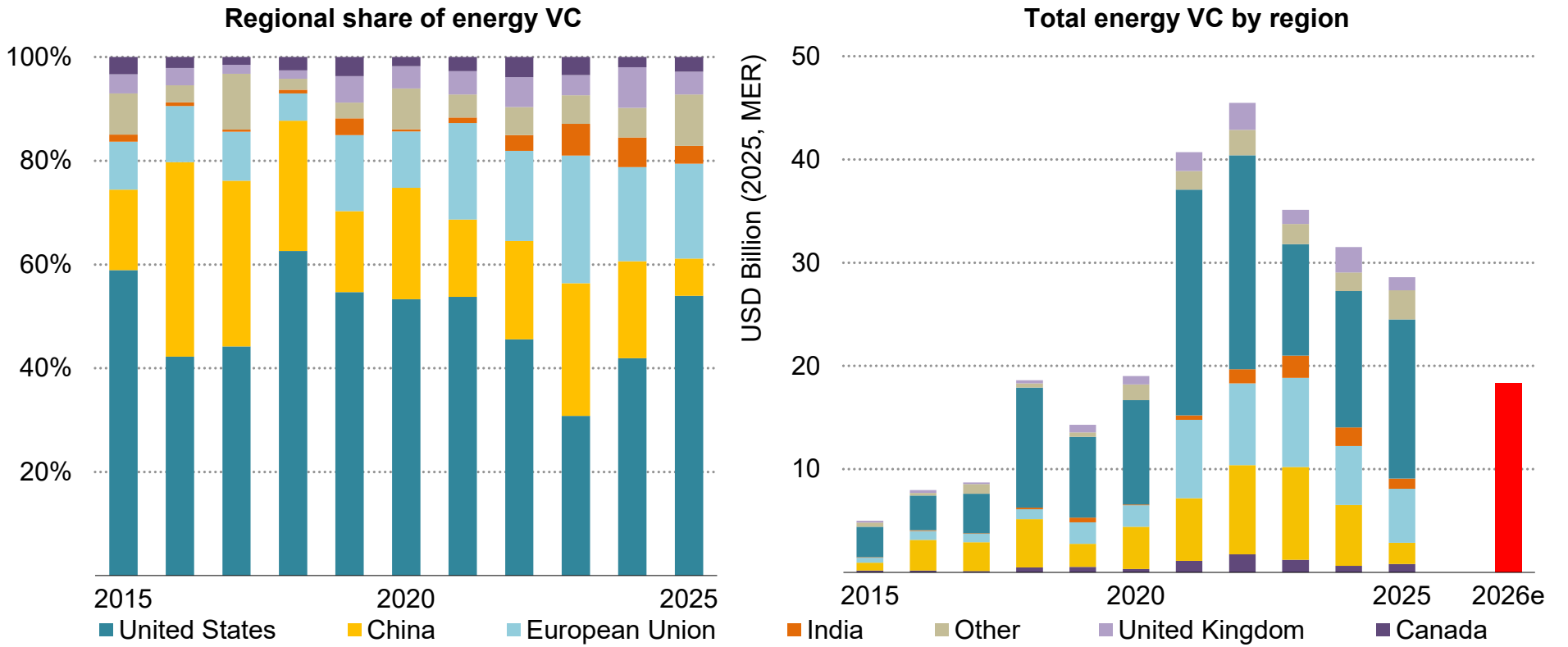
VC funding for start-ups working on grids and other power sector infrastructure has grown from less than 3% of total energy VC after the pandemic to 11% in 2025, for a total of USD 3.1 billion. As with corporate R&D spending by grid manufacturers and operators, this reflects growing recognition of the importance of grids in integrating new generation, supporting end-use electrification and enabling demand-side flexibility through digitalisation and smart technologies. Notable deals include Base Power Company (distributed battery storage) and Lunar Energy (battery storage and virtual power plants), which collectively raised nearly USD 2 billion in 2025. Both these companies represent the opportunities for AI-powered software to boost energy innovation, particularly in a sector such as grids, which has not yet been extensively digitalised.

Some governments are taking an increasingly active role in VC markets, especially in Europe and Canada, where public funds accounted for up to 20% of all energy-related VC in 2025. Funding is largely channelled through public development banks and specialist public funds, with a growing number focused on energy and other strategic innovation areas. In contrast, the private sector dominates the VC industry in the United States, accounting for 99% of energy-related VC in 2025.

Public sector-managed funders and corporate VC investors have strategic concerns that are additional to the 10- to 15-year return on capital that motivates most other VC funds and financial institutions. Public funds aim to support energy innovation in areas that have low returns but are of strategic importance. Corporate funds seek to acquire strategic knowledge and support companies operating in their supply chain. Although the average number of public and corporate strategic investors in 2021-2025 was double that of 2016-2020, their estimated share of funding remained constant throughout 2021-2025 and they have not stepped up as private investors have pulled back.

The United States continues to lead energy-related venture capital (VC) investments

Total venture capital investment in energy-related start-ups by location, 2015-2026e



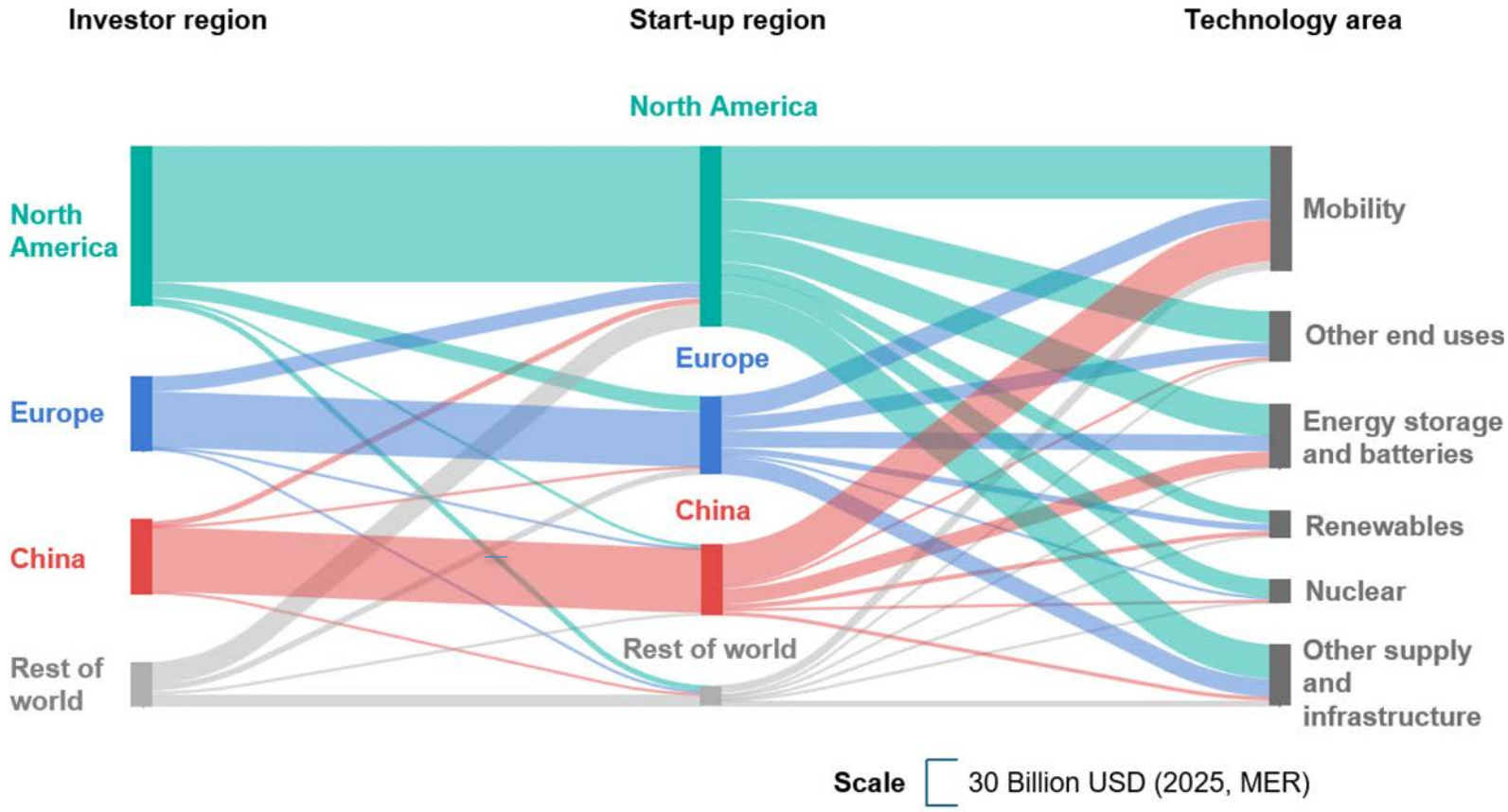
Compared with corporate and public energy R&D, energy-related venture capital (VC) funding is more concentrated in the United States.

Note: MER = market exchange rate. 2026e = estimated.

Source: IEA analysis based on data from Cleantech Group (2025) and Crunchbase (2025).

Energy venture capital (VC) investments are largely domestic focused

Geographic sources and destinations of energy-related venture capital investments, 2015-2025



Unlike other energy investments, which are often spurred by cross-border funding, VC flows are highly concentrated within regions.

Note: MER = market exchange rate.

Source: IEA analysis based on data from Cleantech Group (2025) and Crunchbase (2025).

Energy venture capital (VC) funding is from increasingly diversified sources, though public and corporate investors did not step up when commercial investors began pulling back in 2022

VC pools and deals are highly geographically concentrated, with nearly 70% of total VC investments in 2024 taking place in the United States. The US VC market has played a dominant role in funding energy and other areas of innovation due to the country's deep funding pools for venture capital, existing innovation hubs with strong histories of scaling start-ups and legal frameworks that make it easier to create, grow and develop start-ups. Energy-related VC investments are similarly concentrated, with the United States accounting for nearly half of the USD 255 billion in VC funding for energy start-ups in 2015-2025 and posting the only regional year-on-year increase in energy VC (a 17% increase to USD 15.4 billion).

Compared with other energy investments, energy VC flows come largely from funds investing in start-ups within the same region. In many cases, tax complexities and administrative burdens impede VC flows across borders. Cross-border energy VC investments have increased over time, but generally from VC funds outside of China, Europe and North America being directed towards start-ups in North America (where the innovation ecosystem is highly developed).

Stronger prospects of returns and higher success rates for scaling start-ups mean that VC funding for energy start-ups stems mostly from North America and Europe, collectively accounting for over 83% of all energy-related VC in 2025. Outside of China, the emerging market and developing economies (EMDE) share of global energy-related VC investment is very small, with activity extremely low in Africa, Latin America and the Middle East.

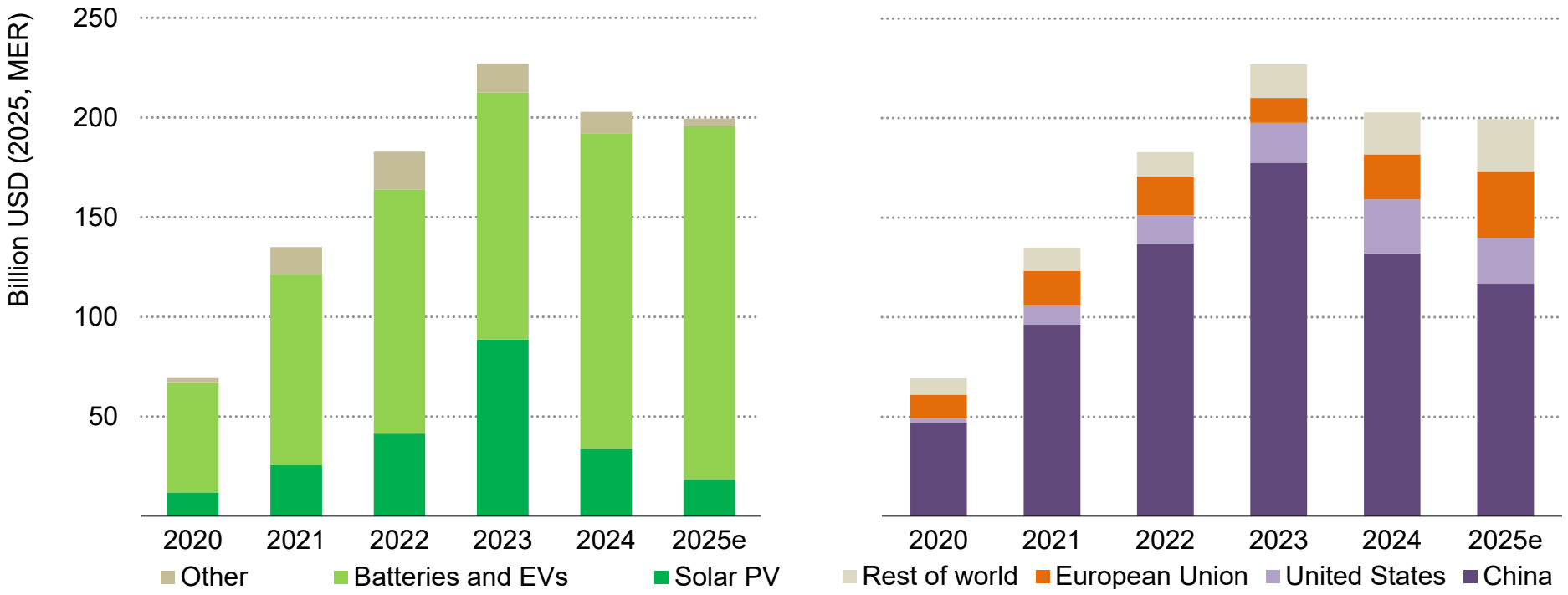
While the meagre funding from major VC markets for EMDE energy start-ups outside of China has also grown, it is typically thanks to very small domestic VC funding pools as well as limited capital market development. The small pool of investors largely directs its capital outwards, to deals and start-ups in North America. Weaker IP enforcement, complex licensing, higher costs of capital and limited regulatory schemes combined deter EMDE VC investments, slowing the emergence of domestically grown solutions and firms that can scale up regionally. Chinese start-ups are also funded largely by Chinese VC funds, due to complications caused by strict capital controls and restrictions on direct investments by foreign investors.

Last year, we covered the growing momentum of European energy VC, which despite posting a slight decrease in 2025 remained high. The European VC sector as a whole has shown modest recovery. Within Europe, Germany and France account for most energy VC deals (over 60% in 2025 by value in Europe), though countries such as the Netherlands and Finland are making up a growing share of energy VC deals in Europe.

Manufacturing and supply chain investments

Investment in clean energy manufacturing has fallen from its peak in 2023, largely due to global solar PV manufacturing overcapacity

Global clean energy manufacturing investment by technology (left) and country (right), 2020-2025e



Investment in clean energy manufacturing reached a high of USD 227 billion in 2023.

Notes: MER = market exchange rate. 2025e = estimated. EV = electric vehicle. “Batteries and EVs” includes anode and cathode active materials, battery cells and electric cars. “Solar PV” refers to polysilicon, wafers, cells and modules. “Other” includes electrolysers, heat pumps and wind turbines, blades and nacelles.

Source: IEA (2026), Energy Technology Perspectives 2026.

Governments increasingly provide fiscal incentives to attract manufacturing investments and accelerate energy innovation, as part of interconnected industrial strategies

Manufacturing is an essential activity for the global economy, with rising demand for energy technologies over the last decade driving a step change in clean energy manufacturing investments. In 2025, investments in batteries, solar PV, wind turbines and EV manufacturing collectively reached nearly USD 200 billion globally. The bulk of investments were in EVs and batteries (70%), while China accounted for 72% of the total across the last 5 years. Although overcapacity in some clean energy supply chains has caused manufacturing investments to decline from the peak of USD 227 billion in 2023, rising demand for clean energy technologies and competition for leadership in future industries is likely to galvanise continued growth.

Attracting investment in domestic manufacturing and supply chains is essential, not only for economic growth but to boost energy security through the reshoring of supply chains. Trade route disruptions and policy uncertainties in recent years have underlined the importance of domestic supply chains to energy security. By accelerating energy innovation through direct public R&D spending and developing supportive innovation ecosystems, governments can create both comparative and competitive advantages in emerging technology areas. These assets promote national competitiveness and help countries attract energy manufacturing and supply chain investments. Boosting energy innovation also enables domestic ownership of intellectual property and advantages in the early stages of commercialisation and technology deployment for countries. Energy innovation is therefore crucial to attract and advance manufacturing investments, especially in emerging areas such as clean technology manufacturing.

Fiscal incentives have long been used to attract investments in manufacturing, with many countries increasingly making them a key part of their economic and industrial strategies (e.g. through special economic zones or tax credits). Investment tax incentives for manufacturing are typically technology- or sector-neutral, with an estimated 79% of tax incentives covering the manufacturing sector as a whole. However, a growing number of tax incentives now target clean energy manufacturing specifically, including the French C3IV tax credit, the US 45X Advanced Manufacturing Production Credit, the Canadian Clean Technology Manufacturing Investment tax credit, and Japan's tax credits for strategic sectors (including clean energy manufacturing).

Developing domestic manufacturing and supply chains also benefits innovation efforts. Having suppliers and industries in close proximity can facilitate cross-firm knowledge sharing and collaboration, boost productivity by attracting highly skilled workers and drive competition. When universities and other research institutions are present, domestic ecosystems can be developed, stimulating technology development while accelerating competitiveness and local economic

growth. For energy innovation – which can be subject to longer capital cycles, rapidly evolving technology landscapes and acute expansion challenges (the "missing middle") – innovation ecosystems can play a key role in advancing competitiveness.

However, a gap persists between basic research (publicly funded) and commercialisation (the target of VC markets) because funding for innovations that reach the commercial stage is limited. Carefully designed support is therefore needed for affordable and secure transitions – especially considering the increasing pressure on national budgets – to ensure that innovations in the lab can advance through all phases (i.e. from prototype to full commercial operations).

The success stories of solar energy in China and wind in Denmark highlight the importance of policy co-ordination to scale up energy innovation and establish domestic supply chains.

Chinese solar industry

China is becoming increasingly dominant in clean energy manufacturing and supply chains globally, including in critical minerals and batteries, and across the solar PV value chain. China has around 85% of solar, 80% of lithium-ion battery and 95% of PV wafer supply chain production capacity globally. These supply chain concentrations stem from the country's co-ordinated clean-industry policy within its wider manufacturing strategy, as well as from the creation of domestic demand at scale. Furthermore, its manufacturers have been exposed to an extremely competitive environment, which drove costs down rapidly.

Solar was identified as a strategic sector in China's 10th Five-Year Plan, leading to the development of a robust and decentralised industrial policy framework that included the deployment of tax credits, innovation subsidies, concessional loans and demand subsidies – in addition to direct fiscal support for production. Strong and sustained policy support has been key not only to industry growth but to manufacturing innovation, with local demand-pull and supply-push policies accelerating process innovation and increasing solar (and related) technology patents. Also, as solar PV manufacturing was geared mainly for export, the government offered direct support for manufacturing investments through low-cost loans, guaranteed purchase agreements and (in some cases) direct cost sharing.

Industrial policy support in China also rests upon a strong human capital and innovation base, with the government prioritising research in its Five-Year Plans and co-ordinating R&D efforts with spending targets. The establishment of supportive ecosystems and industrial clusters has enabled China to develop rapidly and scale up its manufacturing capacity and integrated supply chains. Proximity to upstream suppliers through these clusters and the resultant technology-transfer benefits have been crucial in accelerating the commercialisation of new solar innovations.

Industrial clusters have also acted to boost domestic competition to levels at which Chinese solar PV manufacturers still post negative margins under the global overcapacity in solar PV manufacturing (see Power chapter). State support and production targets have enabled domestic manufacturers to weather these conditions, which

is one of the reasons they can produce panels at a lower cost than the rest of the world. However, some countries allege that these interventions have led to the unfair subsidisation of solar PV manufacturers in China (harming their own domestic manufacturing industries), prompting them to impose tariffs on Chinese solar panel imports. Nonetheless, taken collectively, these early industrial policy interventions were a key factor in the current concentration of solar supply chains (and other clean energy technologies) in China.

Wind industry in Denmark

Denmark has one of the highest wind power grid penetrations in the world and is a global hub for wind turbine manufacturing, home to Ørsted Energy (the world's largest offshore wind company) and Vestas Wind Systems (the largest turbine manufacturer by capacity). Wind power development took off following the 1970s oil crisis, which Denmark was heavily exposed to due to its reliance on fossil fuel imports. Its First Energy Plan in 1976 aimed to reduce this dependency by developing nuclear power, but a domestic anti-nuclear campaign over the next decade caused the government to largely exclude it from future energy planning. Instead, several other energy plans identified wind power as a key alternative.

Consequently, targeted fiscal support and strong policy direction from the Danish government, including through its Second Energy Plan, prompted sustained domestic wind industry growth. In the 1970s and 1980s, the government rapidly expanded its public R&D for renewables (particularly for large-scale wind), funded through energy taxes on electricity. It introduced subsidies for wind and biomass deployment, establishing a strong domestic market and industry. Rapid renewable energy expansion in California at the time also provided export opportunities for Danish wind turbine manufacturers.

Initially, the government offered capital grants of up to 30%; they were progressively reduced during the 1980s and replaced with a feed-in tariff in 1993 under the Third Energy Plan. State support, including through local wind co-operatives (which covered 86% of all turbines by 2001), boosted deployment and domestic demand. Collaboration among universities, manufacturers and energy utilities also enabled more effective technology innovation, including through the provision of publicly funded large-scale testing facilities.

These early efforts were key to the growth of Denmark's wind industry, which now meets nearly 60% of domestic electricity demand. However, the industry has faced some hurdles recently, including an offshore wind tender in 2024 that received no bids due to rising costs and fiscal challenges for Danish wind companies after large-scale projects in the United States were cancelled. Despite these difficulties, greater public support and political priorities favouring domestic manufacturers have enabled a strategic reset.

Implications

Governments and corporations are increasingly recognising the importance of energy innovation, but reductions in public R&D and energy venture capital in 2025 are concerning

After more than a decade of substantial growth, spending by public, corporate and VC funders on energy-related R&D remains high. Nevertheless, drops in 2025 in total public R&D and energy VC investments are areas for concern, with both reflecting continued decreases from highs in 2022 (VC) and 2024 (public). Slowing growth may indicate a new phase for energy innovation funding and shifting priorities, which will require careful navigation to ensure that technologies needed for energy transitions develop to scale.

For many countries, accelerating energy innovation can ensure that they have the means to tackle complex public policy challenges. Many economies are deploying integrated industrial policy-style packages to boost competitiveness and grow emerging industries, and domestic innovation policy is core to these strategies, along with direct spending. For example, South Korea and Japan used targeted tax credits to boost R&D efforts in strategic areas in 2025.

Last year, we discussed how the centres of gravity in the world's energy markets are shifting, with a group of emerging economies increasingly shaping market dynamics. For energy innovation, China has become progressively more dominant, with Chinese public R&D and expenditures by companies headquartered in China accounting for a rising share of global energy-related R&D spending. Outside of China, however, EMDE growth in energy innovation funding has been limited, with R&D spending in 2025 predominantly concentrated in China and advanced economies (96% public, 96% corporate and 90% VC). Strengthening energy innovation ecosystems in other regions, including through international assistance (e.g. from multilateral development banks) will be essential to support affordable and secure energy transitions globally.

Although R&D spending by corporations operating in energy-related sectors remained resilient in 2025, it was the slowest year-on-year growth since 2014 (including 2020). Pressure to boost competitiveness and reduce costs, as well as strong government fiscal incentives to spend on R&D, are likely some of the reasons for this resilience, with Chinese companies increasingly driving growth.

In VC markets, total flows toward energy innovations fell for the third consecutive year from highs in 2022, indicating that reductions are probably more than just a response to broader macro contexts. There is no single reason for the continued decline, though competition for VC capital from AI start-ups and the drop in funding for electric mobility as the sector goes through a maturing period are critical factors. VC plays an important role in financing innovations during the "missing middle" stage between initial technological innovation and commercial scaling, so this decline raises concerns about how future innovations will develop to scale effectively.

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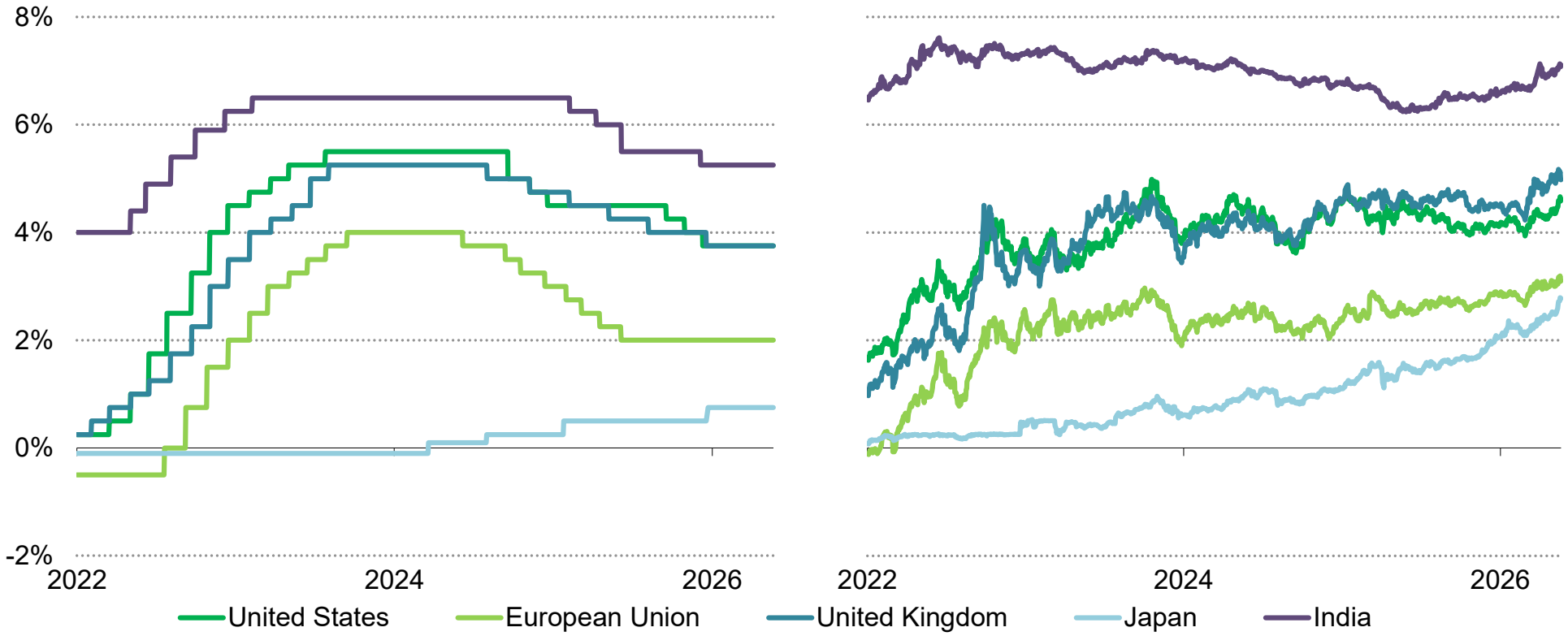
Finance

Overview

Since the outbreak of conflict in the Middle East long-term borrowing costs have risen, although this is not yet reflected in central bank interest rates

Central bank interest rates (left) and 10-year government treasury yields (right) in select countries, January 2022-May 2026

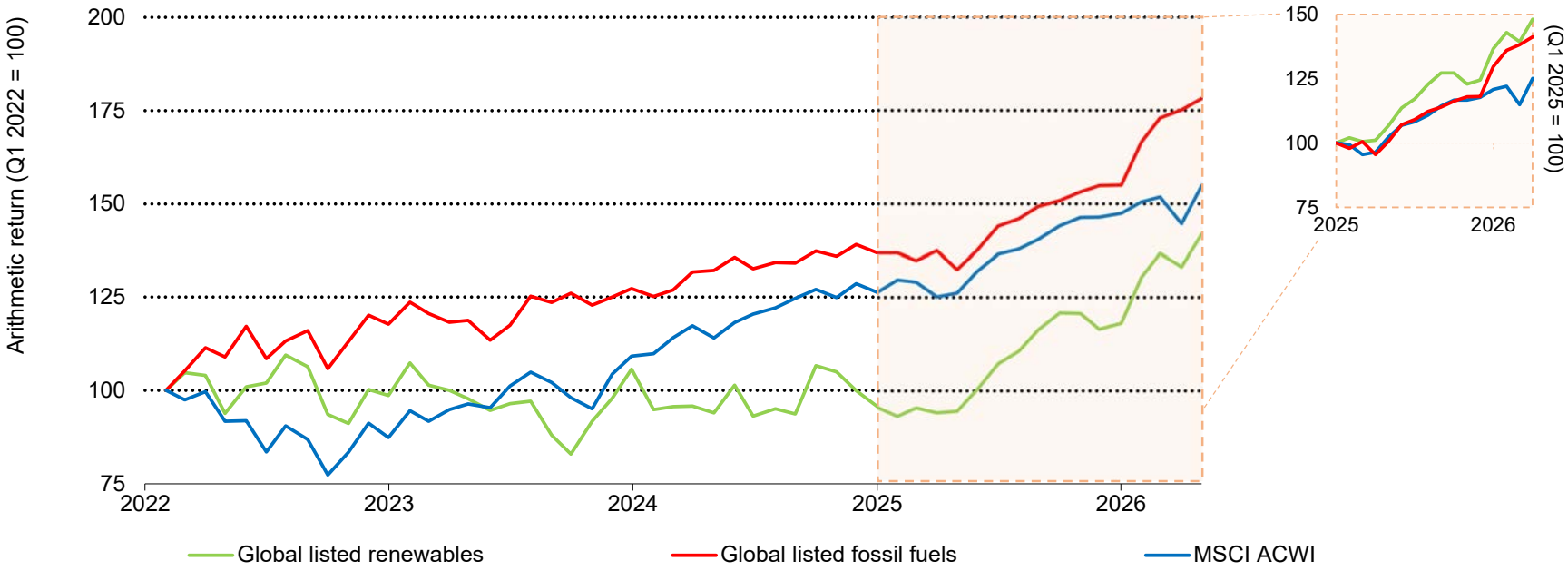


While 2025 saw interest rates falling after three years of rising or flat rates, the conflict in the Middle East has led many central banks to hold rates, with investors expecting increases over the coming year, leading to more expensive debt financing for energy projects.

Source: IEA analysis based on Bloomberg (2026), Bloomberg Terminal (accessed on 21 May 2026).

Fossil fuel companies have performed strongly since 2022, but over 2025 stabilising interest rates and rising electricity demand supported financing conditions for renewable companies

Monthly returns of energy-related sample portfolios, 2022-Q1 2026 (left) and Q1 2025-May 2026 (right)



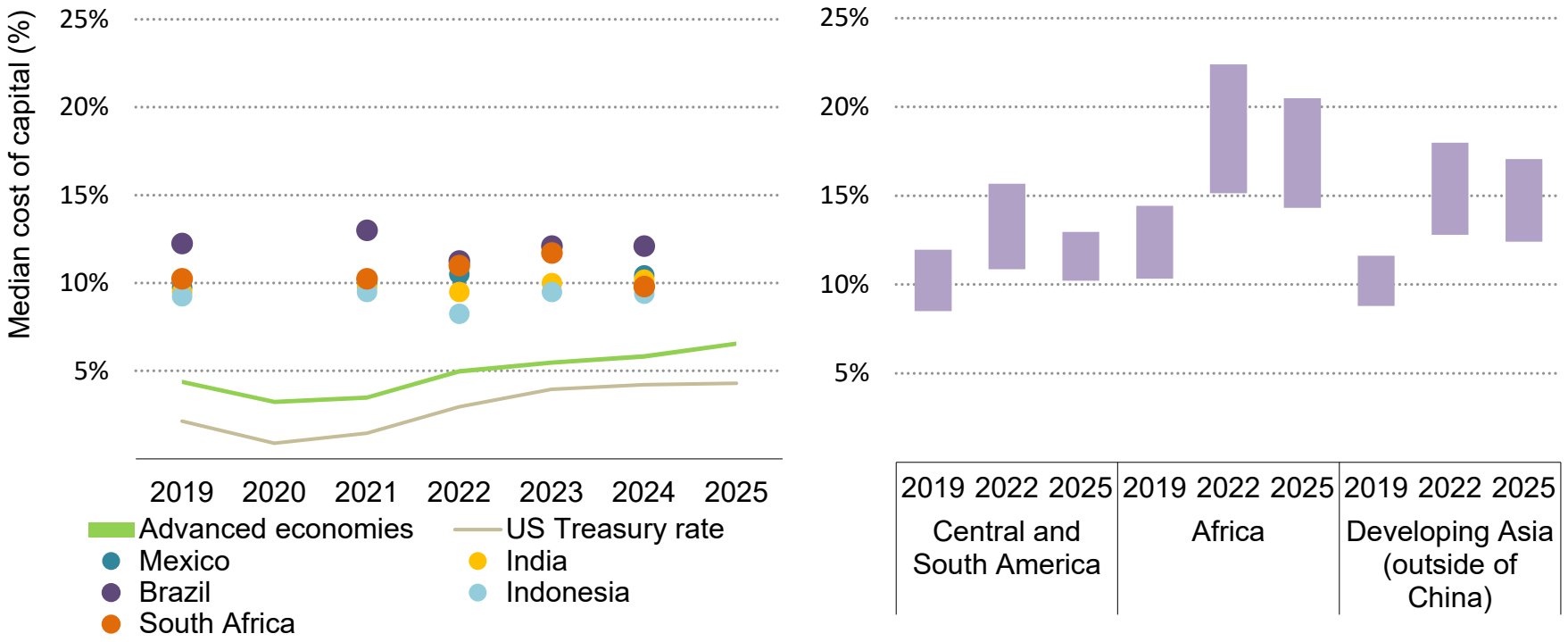
Rapid growth in AI-related electricity demand in 2025 helped boost revenues for renewable energy companies, but rising borrowing costs following the outbreak of the conflict in the Middle East risk putting highly capitalised renewable companies under pressure.

Notes: AI = artificial intelligence. MSCI ACWI = MSCI All Country World Index. Globally listed renewables and fossil fuels portfolios are selected based on relevant Bloomberg Industry Classification Standard (BICS) criteria. Within the portfolios, each company is given equal weighting. Further information can be found in IEA and Imperial College London (2021), Clean Energy Investing: Global Comparison of Investment Returns.

Source: IEA analysis based on Bloomberg (2026), Bloomberg Terminal (accessed on 21 May 2026).

The cost of capital in emerging market and developing economies (EMDE) remains above pre-pandemic levels, with risks of further increases in 2026 due to the conflict in the Middle East

Median costs of capital for solar PV projects in selected countries (left) and regions (right), 2019-2025



A high cost of capital acts as both an indicator of underlying challenges and a direct constraint on the energy project bankability in EMDE. Increased inflation, rising interest rates and currency depreciation caused by the conflict in the Middle East risk further increases in 2026.

Notes: For regional definitions see the Methodology Annex. For region-level data, the minimum to median cost-of-capital range is shown so that countries suffering severe macroeconomic or political crises do not extend the displayed range. For country-specific data, 2020 is not shown due to the impact of the pandemic, and 2024 is the latest year of data in the IEA Cost of Capital Observatory. Both figures illustrate the solar PV cost of capital, which is typically lower or the same for natural gas generation.

Sources: IEA (2025), Cost of Capital Observatory; and Hatton et al. (2025), Historical and Future Projected Costs of Capital.

Interest rate reductions in 2025 improved financing conditions for clean energy technologies, but volatility due to the Middle East conflict has increased long-term debt financing

Base interest rates strongly influence energy investment trends by affecting the cost of raising debt and the rates of return demanded by investors. While major central banks have pursued rate cuts in recent years, the conflict in the Middle East and the risk of a prolonged period of higher oil prices have substantially changed the short-term outlook. Sharp rises to government bond yields (i.e. their borrowing costs) in response to the crisis indicate that investors are expecting rate increases in the European Union and the United Kingdom, as well as a hold on possible US cuts in 2026.

Clean energy projects are generally more sensitive to long-term government bond yields than other energy assets, as their valuations are derived from long-duration discounted cash flows against high upfront capital costs. This has contributed to market underperformance in the higher-rate environment since 2022. By contrast, sustained higher oil prices due to the rebound in demand following the pandemic and the energy crisis in 2022 boosted fossil fuel earnings. Lower financing costs, thanks to rate cuts in major economies in late 2024 and through 2025, combined with rising electricity demand from data centres have improved returns of listed renewable energy companies above overall market increases in 2025.

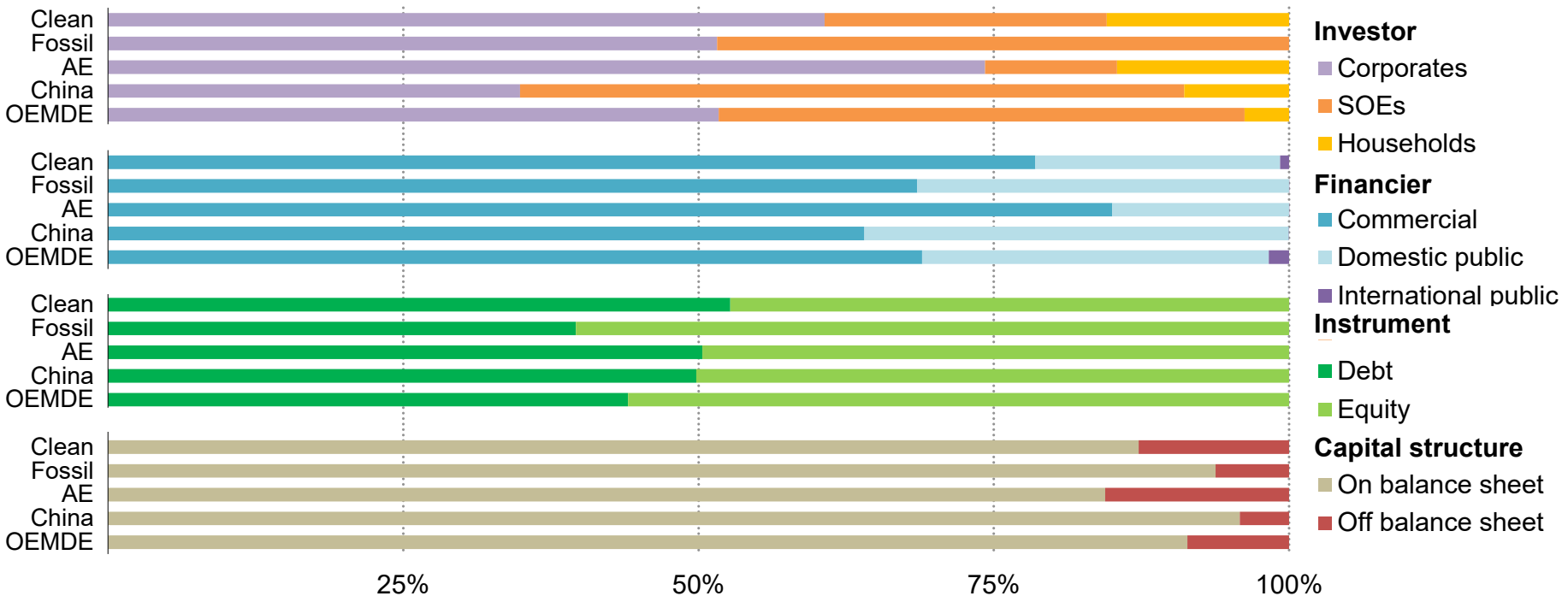
In 2026, energy financing conditions have been heavily influenced by the Middle East conflict. While credit spreads tightened in 2025, there was a significant widening between February and April, resulting in higher lending rates for corporate debt. For fossil fuel companies, which finance a lot of their projects on-balance sheet, higher oil prices may offset the loss of some Gulf production. But for clean energy companies that utilise high shares of debt, higher borrowing costs can make achieving acceptable returns on new or current projects more challenging. While spreads returned to tighter levels in May, volatility likely affected investment in the first half of the year.

This risk is particularly pronounced in emerging market and developing economies, where the cost of capital is already at least double that of advanced economies based on the IEA Cost of Capital Observatory. High inflation, local currency volatility against the US dollar and other macroeconomic challenges account for a large portion of the additional risks that drive up the cost of capital.

As a result of these higher rates, the cost of capital accounts for at least half of the levelised cost of electricity (LCOE, a measure of the breakeven price) for EMDE solar power, compared with an average of one-third in advanced economies and China. High interest rates therefore push up the LCOE of clean energy generation, impeding further investment and making affordability more of a concern.

Most energy investments continue to be made by corporates and financed commercially

Shares of regional and sectoral energy investments by investor, financier, financial instrument and capital structure, 2025



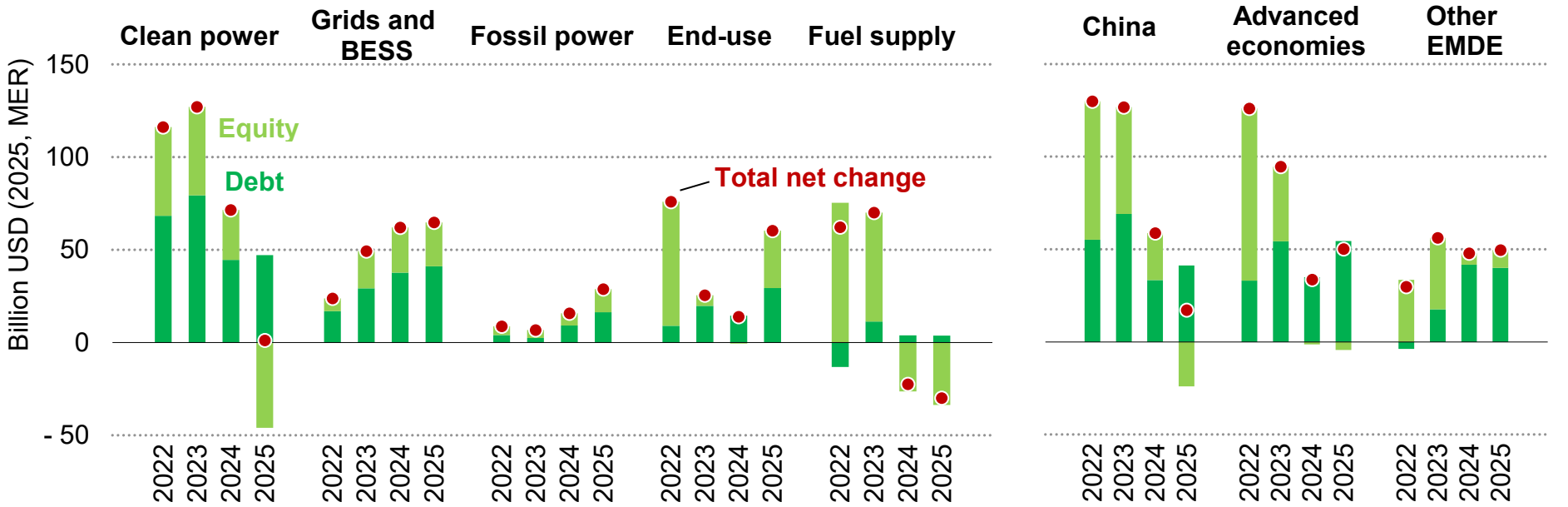
In 2025, almost 60% of energy investments were made by corporates and households, and 75% of all investments were financed from commercial sources, largely from banks, demonstrating the growing role of the private sector in energy financing.

Notes: SOE = state-owned enterprise. AE = advanced economy. OEMDE = emerging market and developing economies other than China. “Clean” refers to low-emissions sectors or assets. “Fossil” indicates unabated fossil fuel supplies and fossil power generation.

Sources: IEA analysis based on S&P Capital IQ (2025) database; IJGlobal (2026), Infrastructure Transaction database; Rystad (2026) database; World Bank (2026), PPI dataset; OECD (2026), CRS dataset; and AidData (2023), Global Chinese Development Finance Dataset version 3.0. All databases were accessed on 18 May 2026 unless otherwise stated.

Debt financing expanded by 10% in 2025, while equity financing, grants and government subsidies declined by 1%

Annual net change in financing by instrument and sector (left) and region (right), 2022-2025



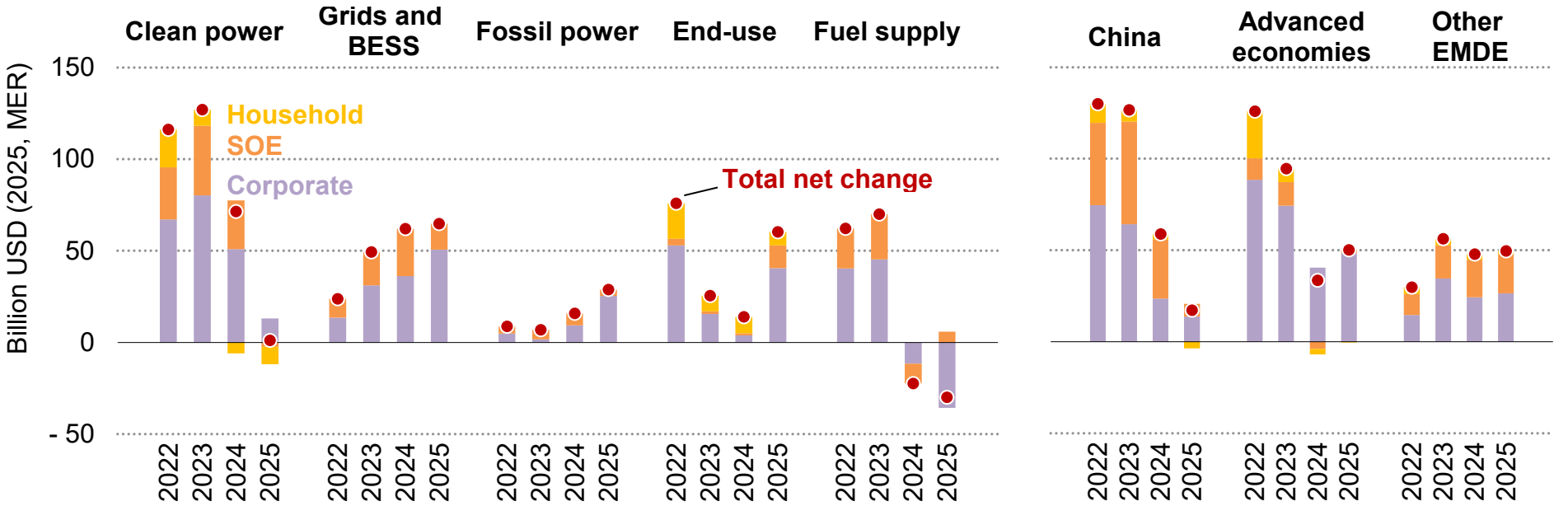
Financing with equity fell in 2025, mainly due to lower fossil fuel supply investments and a decline in public subsidies for renewables. Debt financing remained robust, increasing by USD 140 billion in 2025, primarily for clean power, grids and BESS.

Notes: MER = market exchange rate. BESS = battery energy storage system. EMDE = emerging market and developing economies. Debt includes both bonds and loans for private enterprises, SOEs and households, including concessional debt from development finance institutions (DFIs). Equity covers investments made by private enterprises and SOEs using retained earnings (profits after dividends) and household savings. DFI and export credit agency grants, as well as government tax incentives for capital expenditures, are also included within equity.

Sources: IEA analysis based on S&P Capital IQ (2025) database; IJGlobal (2026), Infrastructure Transaction database; Rystad (2026) database; World Bank (2026), PPI dataset; OECD (2026), CRS dataset; and AidData (2023), Global Chinese Development Finance Dataset version 3.0

State-owned enterprise investment rose 3% and corporate investment 6%, even as fossil fuel supply saw a sharp decline; household spending, by contrast, remained broadly unchanged

Annual net change in financing by investor type and sector (left) and region (right), 2022-2025



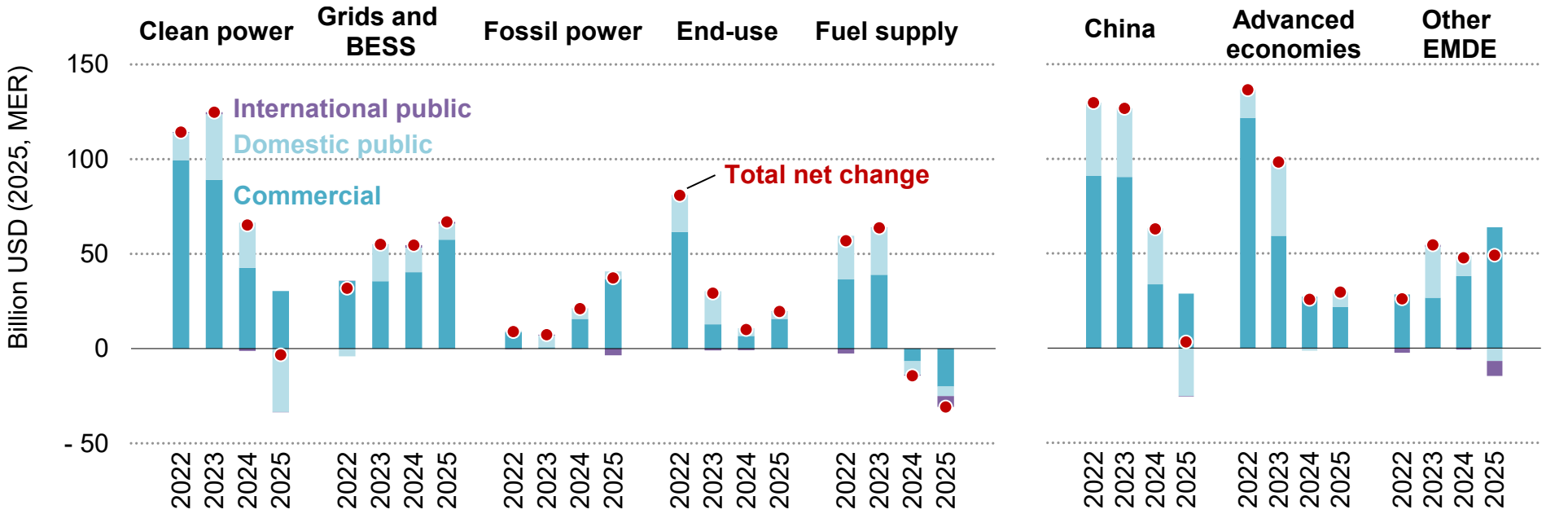
SOE clean power investment declined for the second year in a row, primarily due to steep technology cost reductions for renewables in China. Meanwhile, private investment in fuel supply also fell due to heightened macroeconomic uncertainty and greater capital efficiency.

Notes: MER = market exchange rate. BESS = battery energy storage system. EMDE = emerging market and developing economies. SOE = state-owned enterprise i.e. a company or asset (in the case of buildings, for example) that is majority owned by the state, including national oil and gas companies. “Corporates” are private and publicly listed companies that are not majority owned by the government or government-owned entities.

Sources: IEA analysis based on S&P Capital IQ (2025) database; IJGlobal (2026), Infrastructure Transaction database; Rystad (2026) database; World Bank (2026), PPI dataset; OECD (2026), CRS dataset; and AidData (2023), Global Chinese Development Finance Dataset version 3.0.

While commercial financing broadly continues to rise, domestic public funding for clean power as well as international public financing for fossil fuels dropped sharply in 2025

Annual net change in financing by financier type and sector (left) and region (right), 2022-2025



A reduction in clean power subsidies and SOE cashflow financing, primarily in China, brought down public domestic financing by USD 33 billion in 2025. International public financing also fell USD 6 billion with most reductions coming from fossil power and fossil supply.

Notes: MER = market exchange rate. BESS = battery energy storage system. EMDE = emerging market and developing economies. “Commercial” financing includes equity investments by private enterprises and households (inclusive of self-financing) and debt from financial institutions, and in some cases from state-owned banks. “Domestic public” financing includes public equity in corporations and SOEs, subsidies, tax incentives and financing from central banks. “International public” financing includes DFIs, multilateral climate funds (MCFs), government donors, philanthropies and some official EMDE-directed export credits offered under the OECD arrangement.

Sources: IEA analysis based on S&P Capital IQ (2025) database; IJGlobal (2026), Infrastructure Transaction database; Rystad (2026) database; World Bank (2026), PPI dataset; OECD (2026), CRS dataset; and AidData (2023), Global Chinese Development Finance Dataset version 3.0.

Trends in power and fuel supply financing shifted in 2025 despite modest investment growth

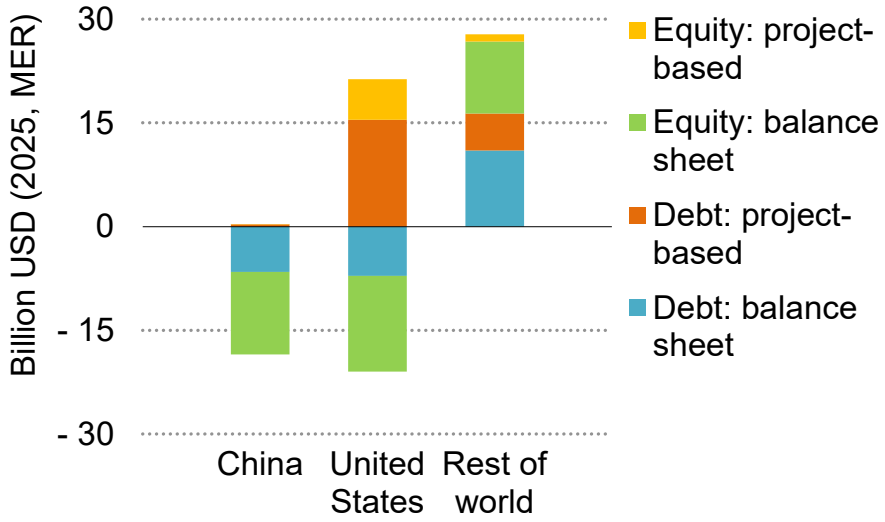
While total global energy-related investment rose to USD 3.3 trillion in 2025 – a 4% increase from 2024 – headline figures mask important shifts in sectoral and regional financing patterns.

In the power sector, investment growth was robust at 7%, driven by strong spending on battery storage, electricity networks and fossil fuel-based generation. Notable developments during the year were a USD 45-billion (-14%) reduction in net equity financing for clean power – the largest annual decline in more than a decade – and a USD 48-billion (11%) increase in net debt financing. Together, these trends indicate a significant shift in the capital structures underpinning clean power investment.

Two underlying factors help explain most of this change. First, investment declined among Chinese renewable energy developers, largely reflecting falling capital costs for solar PV and wind rather than weaker deployment. However, balance-sheet data for Chinese corporates and state-owned enterprises show a larger reduction in total equity (-12%) than in total debt (-5%), the latter mostly originating from commercial sources, resulting in higher leverage and a lower share of financing from domestic public sources.

Second, off-balance-sheet financing for utility-scale clean power projects has become increasingly prominent in the United States, doubling to USD 52 billion in 2025. These projects rely more heavily on non-recourse debt and are typically financed at substantially higher debt-to-equity ratios than projects developed on corporate balance sheets. This has contributed to a notable increase in the share of debt financing for utility-scale renewables – a 6-percentage-point rise from 2024.

Change in net utility-scale clean power investment by instrument, 2025 vs 2024

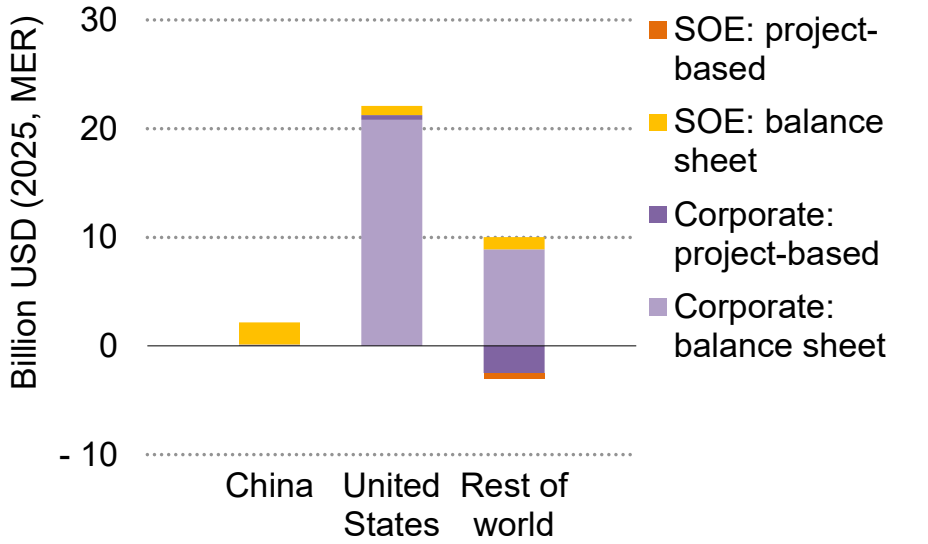


Note: Figure does not include buildings sector solar PV.

Financing trends otherwise remained comparatively stable. Outside of China and the United States, net changes in utility-scale clean power investment were financed through a more balanced mix of debt (50-55%) and equity (45-50%), in line with historical trends. Accordingly, global aggregates conceal divergent financing models

across key markets, with potential implications for risk allocation, balance-sheet resilience and the cost of capital – especially now as markets **re-evaluate the probability of interest-rate cuts this year.**

Change in net fossil power investment by sponsor, 2025 vs 2024



Note: SOE = state-owned enterprise.

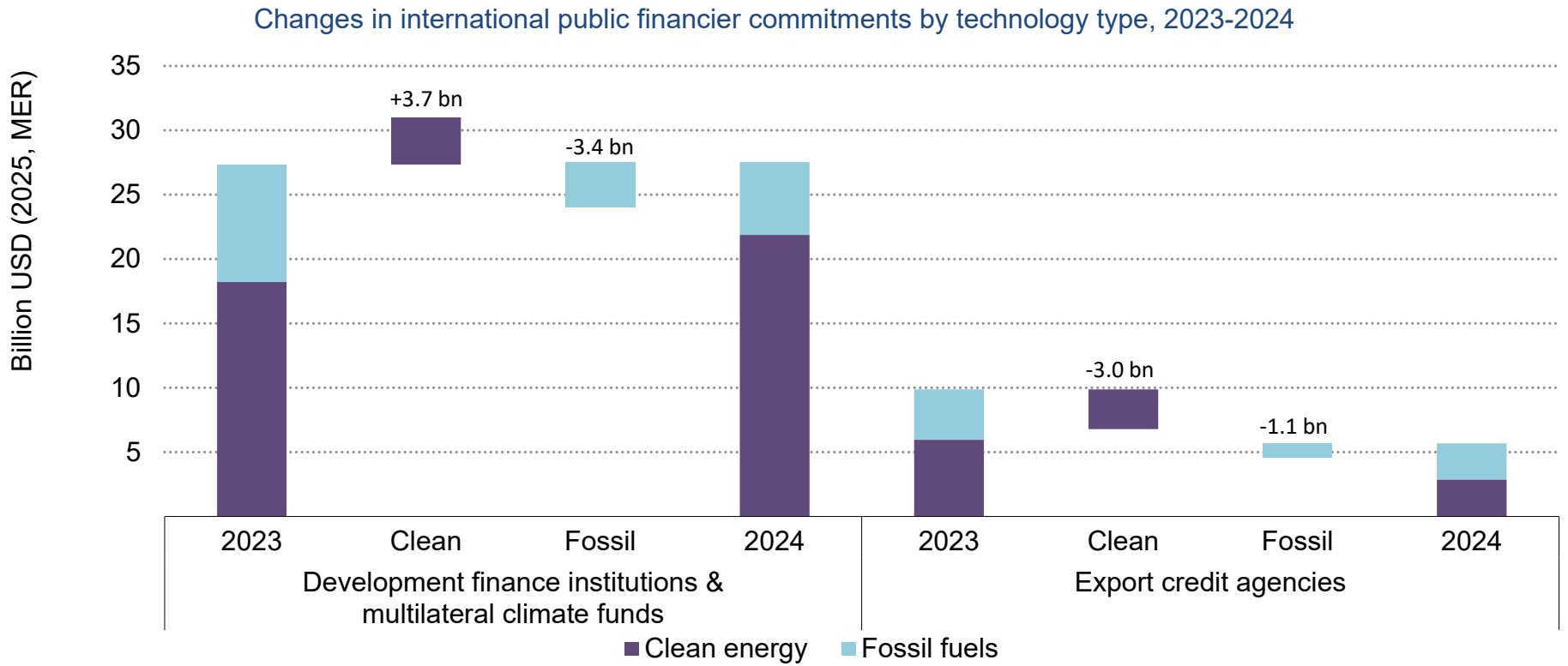
Another notable shift in the power sector concerns the evolving balance between public and private investment in fossil fuel-based generation. State-owned enterprises were the key driver of fossil-based generation investment growth for most of the past decade, reflecting a surge in coal-fired construction in China and a prolonged period of declining investment in advanced economies.

In 2022, however, private corporate investment in fossil generation began to recover as final investment decisions for new natural gas power plants returned to pre-pandemic levels. This rebound accelerated sharply in 2025, with a marked increase in gas turbine orders destined for advanced economies. As a result, private investment in fossil generation reached USD 106 billion in 2025 – a 60% rise from the 2020 level – surpassing SOE investment of USD 76 billion. Unlike for renewables, off-balance-sheet financing structures are relatively uncommon for fossil-based generation projects, meaning that most investments are being financed on the balance sheets of utilities and, more recently, data centre operators.

Similar divergences between public and private investment trends were also evident in fuel supply in 2025, particularly for oil production. Global investment in oil supply declined 6% (USD 35 billion), with US-based corporates – primarily tight oil producers – accounting for more than half of the overall reduction (USD 19 billion). The decline among US corporates resulted mainly from a contraction in equity rather than debt, consistent with a longer-term trend towards greater capital discipline. These companies have continued to prioritise dividends and share buybacks despite lower net income, while also benefitting from significant improvements in the capital efficiency of upstream oil extraction. By contrast, SOE investments proved less sensitive to lower oil prices in 2025, particularly those based in EMDE other than China, increasing marginally in 2025. International public finance for fossil fuel projects also declined, falling by USD 6 billion, broadly in line with previous policy commitments.

Public finance

International public financiers favour clean energy projects and infrastructure, but overall energy support is down compared to last year's levels



Net declines in international public financing for energy reflect an overall decrease in commitments from export credit agencies; meanwhile, the fall in fossil fuel commitments by traditional donors is offset by a commensurate increase in clean energy activity.

Notes: MER = market exchange rate. Values represent commitments from international public financiers outside of China, including development finance institutions, multilateral climate funds, bilateral government financiers and export credit agencies.

Sources: IEA analysis based on OECD (2026), CRS dataset and OECD Export Credit Group (2026) dataset (accessed 20 January 2026).

International public finance is increasingly directed towards system investments, with smaller projects and more varied regional delivery

International public finance (IPF), or cross-border financing from various public sources, mainly EMDE-targeted, is foundational to enable energy investment. IPF helps reduce structural and project-level risks that would otherwise deter private capital, including regulatory uncertainty, weak balance sheets and currency exposure. In 2024, international public financiers committed around USD 58 billion to support energy-related EMDE investments. Development finance institutions (DFIs) accounted for over 45% of these commitments, while multilateral climate funds (MCFs) and other bilateral funding channels each represented around 1%. Export credit agencies (ECAs) contributed close to 10%, and Chinese institutions – including DFIs and public bilateral lenders – made up nearly 40%.

What happens in 2026 will be less the result of new approvals than of disbursements of project commitments made in recent years. From 2023 to 2024, the mix of official development assistance (ODA) and other official flows (OOF) already indicated a shift towards clean energy and system enablement. Net totals declined, largely because fossil fuel commitments had fallen by more than USD 4.5 billion, while those for clean energy increased modestly.

The shift is not only towards renewables but also towards the infrastructure needed to integrate and operate them reliably. Transmission and distribution projects, together with loss-reduction programmes, account for around USD 12 billion in commitments, compared with roughly USD 14 billion for renewables, indicating that system investment is approaching a similar scale. At the same time, efficiency-related interventions are increasingly prevalent, although the decline in average project size suggests that these tend to be smaller-scale investments rather than large standalone projects.

IPF delivery will differ by region. In Africa, the project pipeline remains grid-first and access-oriented. Grid upgrades, smart metering, loss-reduction programmes, mini-grids and solar home systems make up a notable share of commitments, but average project size is smaller than in previous cycles. As a result, flows will depend less on a few mega-projects and more on the pace of procurement, permitting and local implementation. In India and other parts of Asia, multi-component grid upgrades, distribution strengthening and solar projects dominate the pipeline.

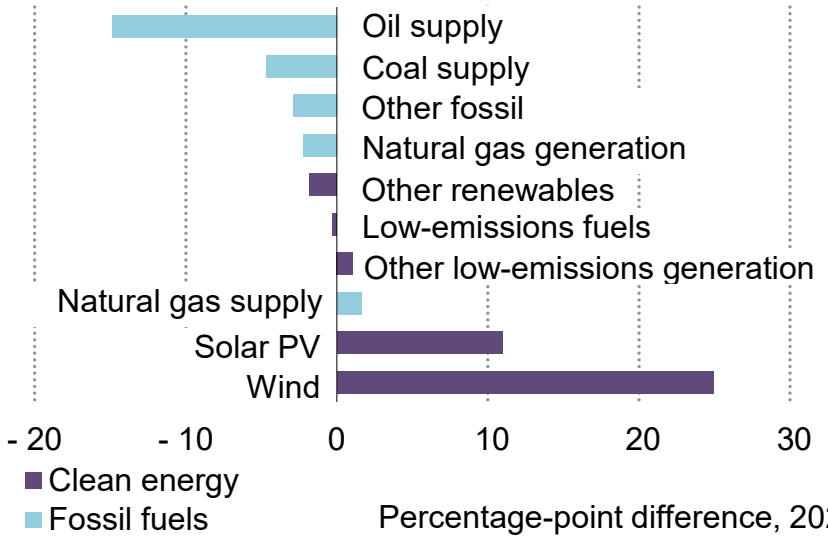
Meanwhile, the project mix of grid modernisation and rural electrification in Latin America indicates that part of 2026 spending will be directed towards early-stage preparation to perform extended feasibility, permitting and tender preparation. In emerging Europe and the Middle East, projects tend to be larger, with fewer, capital-intensive commitments spanning renewable generation and grid infrastructure rather than access-focused solutions.

The financing structure of recent IPF commitments still reflects tighter public budgets, with the majority committed as debt, while grants and guarantees make up a smaller share. Since many projects are financed in hard currency, utilities and distribution companies may face challenges in servicing this foreign-currency debt. The changing project profile reflects a shift towards smaller and more numerous investments, with a growing predominance of small-scale interventions, potentially creating more administrative requirements or implications for disbursement speeds.

Drilling down to the institution level, the IPF picture is uneven. DFIs are likely to remain the backbone of energy-related disbursements for 2026, with commitments focused on physical system assets, notably transmission and distribution, utility-scale renewables and large efficiency projects. MCFs are more concentrated in smaller and more fragmented project portfolios, with a notable share of projects involving technical assistance and institutional support.

EMDE commitments by ECAs have fallen overall, due to the sharp drop in large wind generation packages. Fewer major projects reached financial close, reducing demand for export-linked ECA financing, although transactions in 2025 point to continued support for large-scale projects despite pipeline uncertainty. However, Chinese financing continues to reach EMDE recipients, albeit through different forms as commitments are shifting from a predominantly DFI-driven model towards more commercial instruments such as equity stakes that mobilise the participation of Chinese companies.

ECA allocation difference vs global energy investment mix, 2024



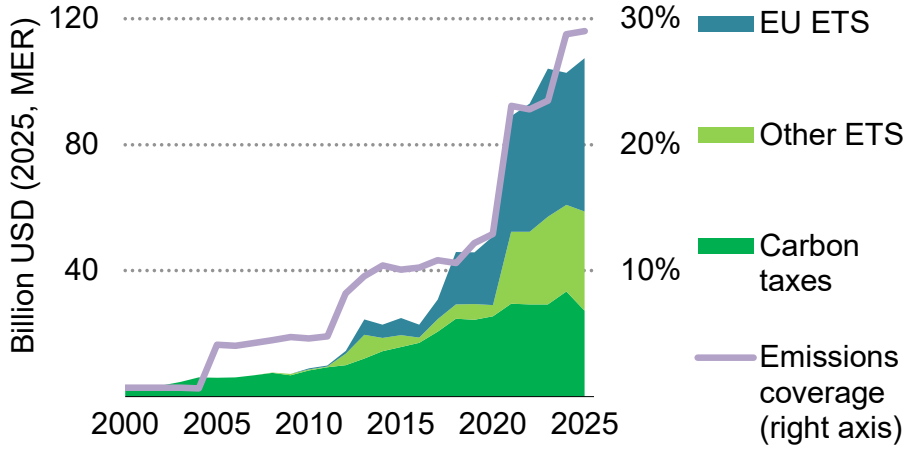
Note: ECA = export credit agency.
Source: IEA analysis based on OECD Export Credit Group (2026) dataset (accessed 20 January 2026).

The decline in fossil fuel commitments reinforces a shift in IPF delivery. New unabated coal commitments are close to zero, gas transmission projects have dropped sharply, and oil financing is largely limited to refinery modernisation. This evolution began in the more constrained international finance environment of 2025, marked by a sharp decline in ODA. Overall, sector IPF in 2026 is likely to be leaner than in previous years but cleaner in direction, increasingly focused on the system upgrades that allow new technologies to be used cost-effectively.

Carbon pricing raised USD 107 billion in 2025, remaining a key energy and climate policy instrument, while growing activity linked to Article 6 could offer EMDE new fiscal opportunities

Compliance carbon pricing instruments (CCPIs), including carbon taxes, emissions trading systems (ETSs) and hybrid approaches, raised an estimated USD 107 billion globally in 2025, a 2% rise from 2024. The EU ETS is the largest in the world in terms of revenues, constituting nearly half of the global total. While often the main purpose of CCPIs is emissions reductions, they can also function as a revenue-raising tool for governments and drive innovation and competitiveness in clean energy technologies.

CCPI revenues and emissions coverage, 2000-2025



IEA. CC BY 4.0.

Notes: MER = market exchange rate. CCPI = compliance carbon pricing instrument. ETS = emissions trading system.

Source: IEA analysis based on World Bank (2026), States and Trends of Carbon Pricing 2026

Some CCPIs have recently faced scrutiny over their climate ambition, distributional effects, impacts on energy prices and knock-on implications for economic competitiveness. However, developments this year have reaffirmed the significance of CCPIs for energy and climate policy. The European Union agreed to a binding target to reduce greenhouse gas emissions 90% compared to 1990 levels by 2040 and is expected to propose a revision of its ETS rules by July 2026, while continuing to develop the Carbon Border Adjustment Mechanism. Some jurisdictions are strengthening or expanding existing ETS frameworks, including China, California, Korea and the United Kingdom, while others are developing or formalising new CCPIs, such as Brazil, Chile, India, Japan, Türkiye and Viet Nam.

Carbon credits are another carbon pricing mechanism. For EMDE projects, international co-operation under Article 6 of the Paris Agreement is increasingly seen as an additional opportunity to mobilise revenues, especially in the energy sector. As of April 2026, more than 40 bilateral co-operation agreements under Article 6.2 had been signed by over 30 countries. Of the nearly 40 pilot projects in Article 6 bilateral agreements, around 90% are in the energy sector. To date, however, transaction volumes remain limited, meaning that the full revenue and mitigation potential of Article 6 co-operation has yet to be realised.

Private finance

The proliferation of sustainable finance and sustainability disclosure regulations has slowed, with reporting requirements under examination and focus shifting towards transition finance

Sustainable finance and sustainability disclosure regulations expanded rapidly in the early 2020s, reshaping how capital markets price and report climate-related risks. The underlying rationale was systemic: regulators including the Financial Stability Board and International Sustainability Standards Board (ISSB) argued that without consistent disclosure, investors could not adequately price climate-related risks, leaving vulnerabilities across the financial system. Not all stakeholders agreed: critics argued that mandatory climate reporting conflicted with fiduciary responsibilities and imposed compliance costs that were difficult to justify in terms of demonstrable investor benefit. This tension has not been resolved, and it continues to drive the current wave of regulatory reform.

By 2025, the momentum had shifted. The direction of travel across major economies has moved towards streamlining or scaling back requirements – though the extent and nature of change differ markedly by jurisdiction. In the European Union, efforts to streamline sustainable finance regulations under the omnibus reform package announced in February 2025 significantly narrowed the scope and depth of sustainability disclosure requirements.

Compliance costs fell as a result, but the effect on data availability is more limited than the headline changes imply: large enterprises – which account for the bulk of emissions-intensive activity – retain mandatory reporting obligations for emissions and transition plans. For banks, the tension is more acute: corporate disclosure requirements have narrowed at the same time as prudential expectations on climate risk have grown, with guidance from the European Central Bank and the European Banking Authority placing heavier demands on financial institutions' own climate data needs.

In the United States, the Securities and Exchange Commission (SEC) climate disclosure rules of March 2024 effectively never came into force, representing a substantive reorientation of policy. Outside of both jurisdictions, EMDE disclosure frameworks have continued to expand. ISSB adoption – now under way in over 40 countries – is the clearest expression of this trend, creating the data infrastructure upon which broader sustainable-finance frameworks depend.

Investor responses to this evolving landscape have not been uniform. Asset managers, particularly in the United States, have distanced themselves from net-zero and sustainable finance initiatives, partly due to legal concerns about co-ordinated climate commitments. Asset owners take a different view: with longer investment horizons, they continue to treat climate risk as financially material – a position reflected in surveys of asset owners and, increasingly, banks – and some are reallocating mandates away from managers without credible transition strategies.

The latest revision of the Net-Zero Asset Owner Alliance target-setting protocol reinforces this direction, introducing a "transition target" alongside sectoral emissions reduction targets to allow investors to support decarbonisation in high-emitting sectors while maintaining portfolio-level emissions commitments.

Governments are increasingly directing investments towards industrial decarbonisation, particularly in Asia, where transition finance frameworks are being developed to address emissions-intensive sectors that fall outside of conventional green finance taxonomies. Japan has developed transition roadmaps for emissions-intensive industries such as steel, chemicals and power generation, setting out key technologies and deployment timelines as part of its Green Transformation (GX) strategy.

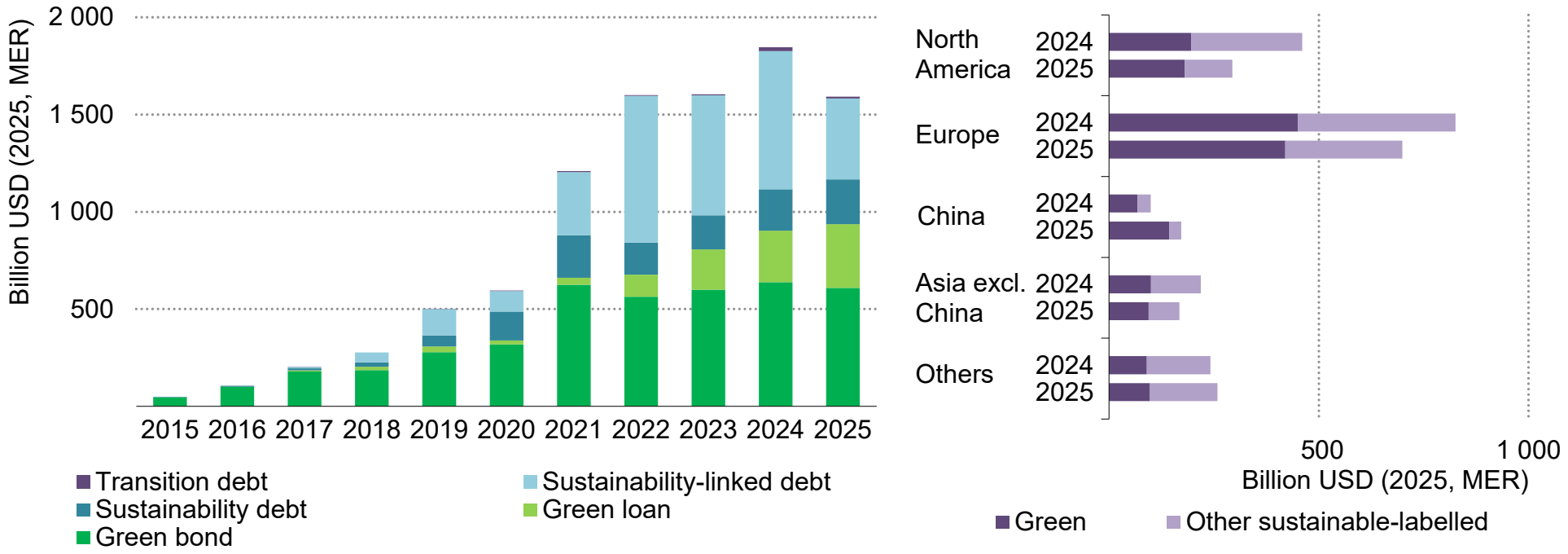
Authorities in Korea are also developing a transition finance framework to support decarbonisation in manufacturing sectors, alongside initiatives such as a KRW 150-trillion National Growth Fund targeting strategic industries. In China, subnational transition finance guidelines have demonstrated effectiveness in attracting investment to the steel sector, with national regulators reviewing further incentives. Outside of Asia, the United Kingdom has also developed Transition Finance Guidelines calling for the use of third-party credible reference pathways and has prioritised mandatory transition plans to guide capital allocation.

Meanwhile, EMDE sustainable finance frameworks have continued to expand. Most new frameworks are built around green or sustainable finance taxonomies that serve as the basis for bond and loan labelling and are often accompanied by state-led issuance programmes. About 80% of the 56 sustainable finance taxonomies currently in force or under development globally are of EMDE origin.

Several notable taxonomy updates occurred in 2025, including in Brazil, India and Australia. China also updated its Green Bond Endorsed Projects Catalogue, expanding it to include green trade and activities related to clean technology exports. Under the COP30 Brazilian presidency, a Taxonomy Roadmap Initiative has also been implemented to improve interoperability among taxonomies, for example with development of the Sustainable Finance Taxonomy Mapper, which will simplify relevant cross-border investments.

The resilience of sustainable-labelled debt markets in 2025 reflects continued green debt growth, with challenges in key markets prompting greater regional diversity

Sustainable-labelled debt amounts by type, 2015-2025 (left) and by region, 2024-2025 (right)



Despite declining US issuance and a contraction of sustainability-linked debt, green debt has continued to show steady momentum, with China, Asia and Latin America reducing Europe-heavy market concentration.

Notes: MER = market exchange rate. “Others” refers to Africa, the Middle East, Central and South America, Eurasia and other countries. Sustainable debt refers to the combined total of bonds and loans. For categories other than green, only the aggregate amount of bonds and loans is shown, as they tend to have smaller volumes. “Sustainability debt” is any type of instrument for which the proceeds or an equivalent amount is used exclusively to finance or refinance a combination of both green and social projects.

Source: IEA analysis based on Environmental Finance (2025) database.

Sustainable debt markets are shifting to favour projects with strong fundamentals over reputation, with frameworks evolving to support energy security and transition needs

Total issuance of labelled sustainable debt reached USD 1.5 trillion in 2025, a 14% drop from 2024 but still broadly in line with 2022 and 2023 levels. Green bonds remained the dominant financing instrument with steady issuance volumes, but growth in green debt was underpinned by green loans, with bilateral and syndicated bank loans increasing ninefold in absolute value over the last five years.

The initial boom in green debt was sparked in part by the idea that it would attract a "greenium" – a price benefit for issuers compared with traditional bonds. In recent years, however, there has been limited clear evidence of a greenium effect, indicating that project or corporate fundamentals are driving activity in green-labelled sectors. Capital allocation is increasingly gravitating towards projects that offer both cashflow visibility and strong alignment with the current energy security discussion. Reflecting this trend, nuclear energy was added to the updated UK Green Financing Programme, which is expected to support further financing in the sector.

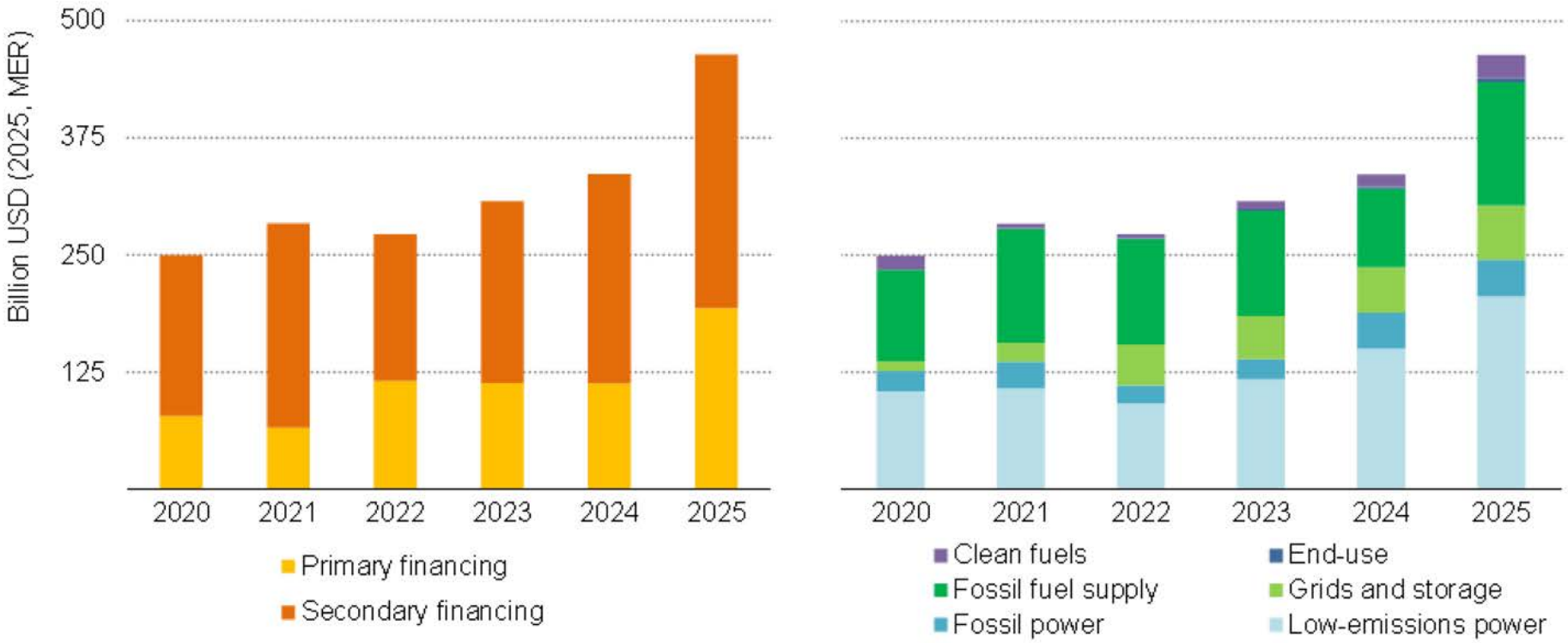
Despite steady green debt performance, sustainability-linked bonds (SLBs) recorded a large contraction due to concerns over reputational risks, structural and reporting complexity, and a drop in attractive publicity to incentivise issuers and investors. This reflects a broader trend within the market as environmental, social and governance (ESG) headwinds minimise regulatory risks and reduce the reputational gains that drove a surge in labelled issuances, particularly SLBs.

In sustainable debt markets, regional divergence grew in 2025. In Europe, implementation of the EU Green Bond Standard precipitated a qualitative improvement in the market. The European Investment Bank issued its inaugural bond under the standard and, despite last year's stagnation, the market outlook remains stable. Conversely, North American issuances fell 36% from 2024, with issuers increasingly witnessing diminishing value when labelling transactions as sustainable finance. While corporations have maintained capital flows to energy companies and assets, they increasingly opt against labelled debt, focusing instead on pure financial activities.

China recorded robust year-on-year growth in sustainable debt as green debt more than doubled compared to last year – the largest increase of any region. While aggregate volumes across the wider Asia region contracted, accelerating transition finance momentum established a strong foundation for future expansion. Indeed, financing transition in hard-to-abate sectors is becoming increasingly prominent. The International Capital Market Association Climate Transition Bond Guidelines and a new guide from the Loan Market Association on transition loans have established clear frameworks for products, the lack of which has stymied growth to date.

Bank lending to develop new projects increased significantly in 2025, with rising energy security needs likely driving loan growth across various sectors

Project finance provided by banks to the energy sector by financing type (left) and by sector (right), 2020-2025



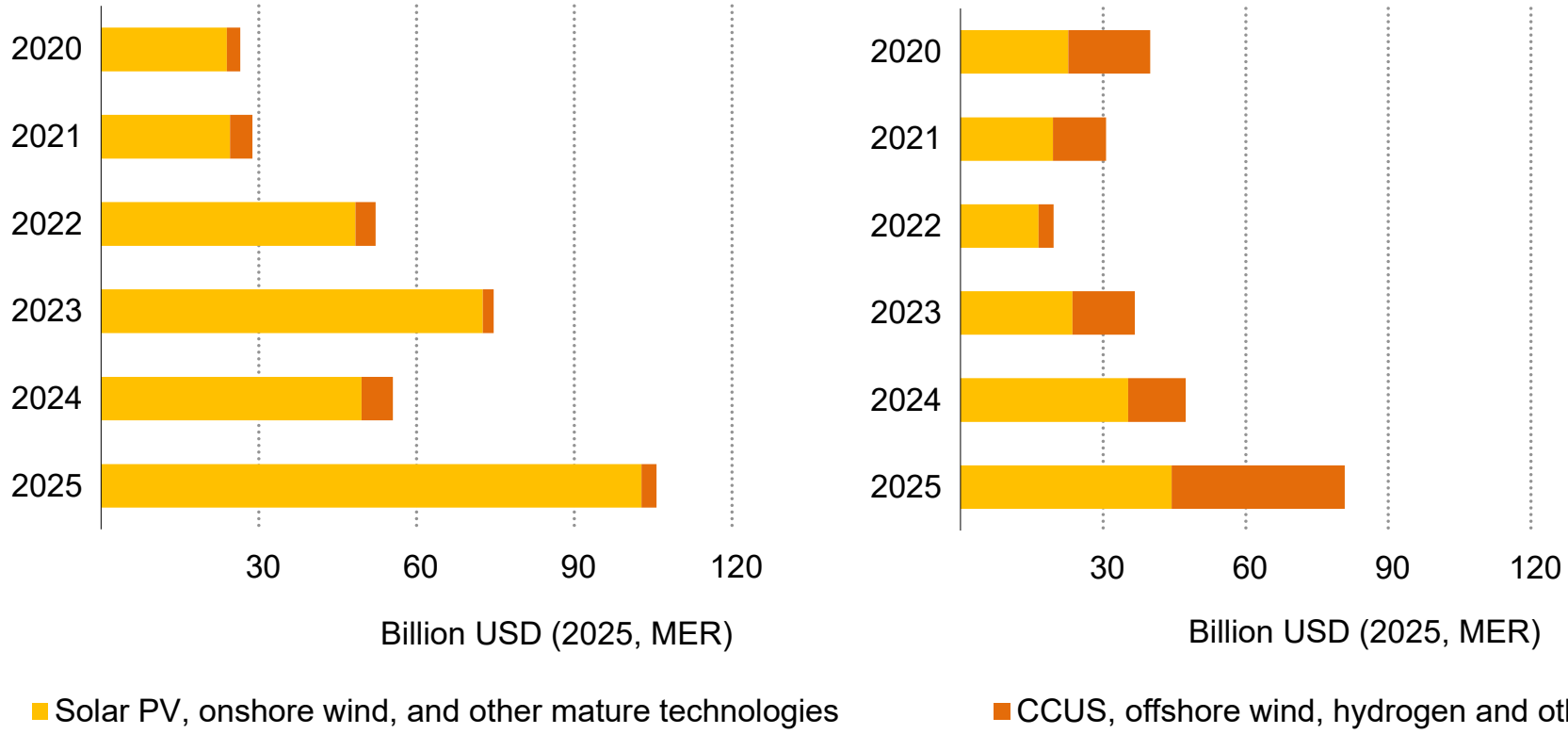
The amount banks provided to energy companies in project finance transactions increased in 2025 for both new and existing projects, reflecting interest across all categories, including both fossil fuels and low-emissions technologies.

Notes: MER = market exchange rate. “Primary financing” includes primary project finance and portfolio financing. “Secondary financing” refers to refinancing, acquisitions and additional facilities. “End-use” does not include retail banking loans to consumers.

Source: IEA analysis based on IJGlobal (2026), Infrastructure Transaction database.

Lending within the United States has been heavily concentrated in mature sectors, while government support has created a more balanced lending profile in other OECD countries

Project finance provided by banks to clean energy projects in the United States (left) and other advanced economies (right), 2020-2025



Energy investment drivers vary by region, with the United States demonstrating robust market-led acceleration. Meanwhile, other advanced economies are sustaining momentum through a balanced combination of mature and nascent technologies.

Notes: MER = market exchange rate. CCUS = carbon capture, utilisation and storage.
Source: IEA analysis based on IJGlobal (2026), Infrastructure Transaction database.

Energy security concerns are boosting bank financing for new energy projects, with market conditions being the main US driver and policy incentives remaining key elsewhere

Given their scale, balance sheet capacity and ability to structure and underwrite complex capital-intensive projects, banks play a central role in global energy financing. Thus, momentum for bank-provided financing for energy-related projects globally remained robust in 2025, growing by roughly 20% and marking the third consecutive year of growth. While this is only one component of overall bank lending, with banks also providing corporate loans directly to companies, this expansion in energy financing points to sustained confidence in the cashflow resilience of energy projects, even amid relatively high interest rates.

Banks provide both primary and secondary financing for clean energy projects. While secondary finance tends to dominate bank lending, in 2025 primary project financing from banks for energy projects surged by around 45% compared with 2024. The heightened global focus on energy security and robust growth in electricity demand across multiple markets likely helped drive this uptick.

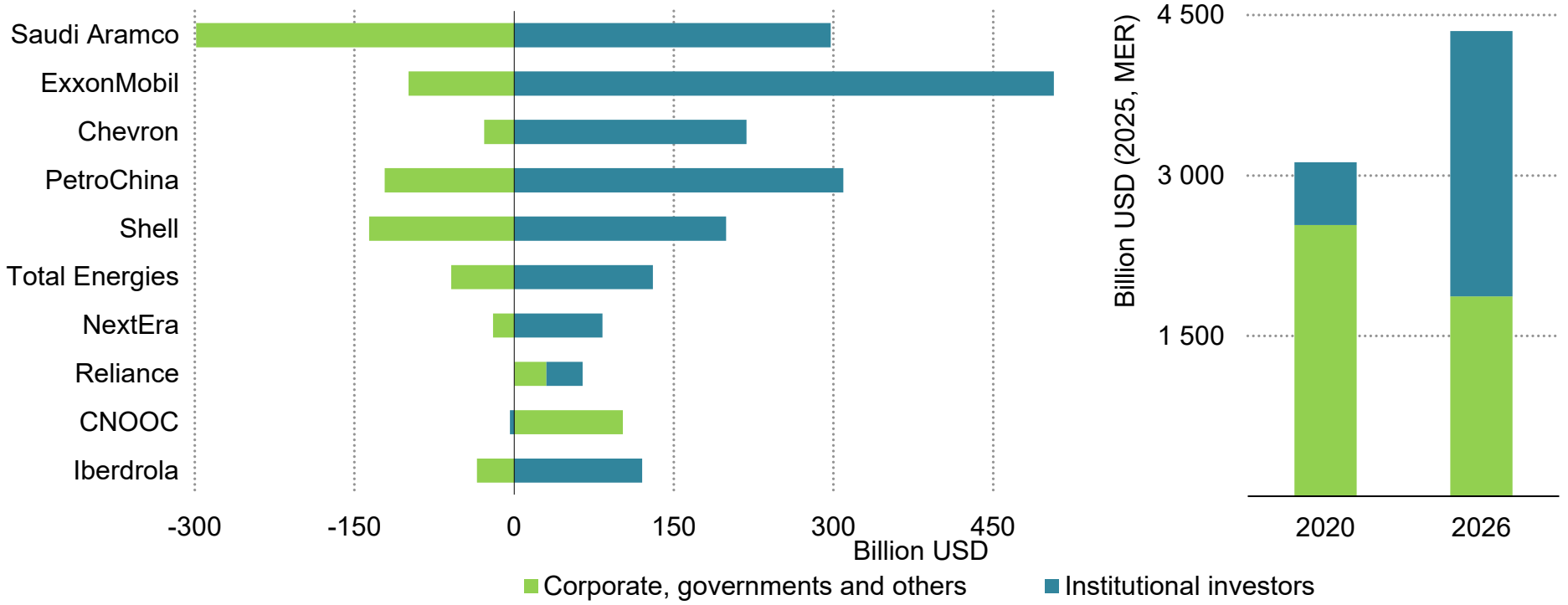
Furthermore, the broader energy landscape is currently shifting from expansive policy support to accelerate the energy transition in some markets, towards more multifaceted policy priorities, notably energy security, affordability and economic resilience. Trends across different energy project types reveal distinct regional divergences in how this shift is materialising. In the United States, bank lending for mature technologies with well-established business models (e.g. solar PV) has been notably robust. In fact, it is 36 times higher than for sectors that banks may consider higher risk because the technologies are more nascent (e.g. CCUS) or because government support is required to generate cash flows (e.g. grids and offshore wind).

Conversely, banks in other regions exhibit a more balanced lending approach regardless of project type. Despite the macroeconomic challenges, sectors that are more likely to rely on government support have maintained solid deal volumes through selective and strategic project execution. In Europe, continuous government backing for offshore wind, including site development support and government-funded transmission lines (e.g. the Hollandse Kust Zuid project in the Netherlands), reduces infrastructure risks and endorses commercial bank lending.

Equally, direct government funding of CCUS and associated anchor projects (e.g. the United Kingdom's HyNet North West project) has allowed banks to provide project financing. A key question is whether these distinct regional trajectories and the resilience of primary financing will persist throughout 2026 in a more volatile financing environment.

Energy company ownership has shifted strongly towards private institutional investors

Net change in ownership of the top 10 listed energy companies by type, 2020 vs 2026 (based on market capitalisation in April 2026)



Market capitalisation of the top 10 energy companies has grown more than one-third since 2020, and institutional investors dramatically expanded their stake from 18% to nearly 60% while governments and corporates largely retreated.

Notes: MER = market exchange rate. CNOOC = China National Offshore Oil Corporation. Institutional investors include asset managers, infrastructure funds, insurance companies, pension funds, private equity and sovereign wealth funds. "Others" refers to individuals, holding companies and family offices and trusts. Market values are as of early April 2026.

Sources: IEA calculations based on Thomson Reuters (2020), Eikon database and Bloomberg (2026), Bloomberg Terminal.

The ownership base for some of the largest listed energy companies is shifting from governments and corporates to large institutional investors

In 2020, total market capitalisation of the top 25 energy companies was about USD 4.3 trillion, with Saudi Aramco accounting for over 40% (USD 1.8 trillion). Today, Aramco has a broadly similar valuation, but the total value of the group of companies has grown to almost USD 6 trillion. This list is largely dominated by oil and gas sector companies, which make up 18 of the 25 largest energy companies by market capitalisation. The role that governments and corporates play in this ownership base has largely shrunk, leaving institutional investors with a much larger share.

This shift began in the early 2020s with the development of passive investing, led by a handful of large asset managers. The result is an increasing concentration of ownership in the hands of global players such as BlackRock, Vanguard and State Street. This trend applies to fully private companies and SOEs alike. In 2020 roughly half of the market capitalisation of private companies in the analysed sample was held by institutional investors, rising to over 85% in 2026.

Among the largest listed SOEs, ownership by institutional investors rose from 3% of the equity in 2020 to about 30% in 2026 (from 10% to over 60% if Saudi Aramco is excluded). This effect can be partly explained by the delisting of Russian companies following Russia's full-scale invasion of Ukraine, but it also highlights a step change in how energy companies are being financed.

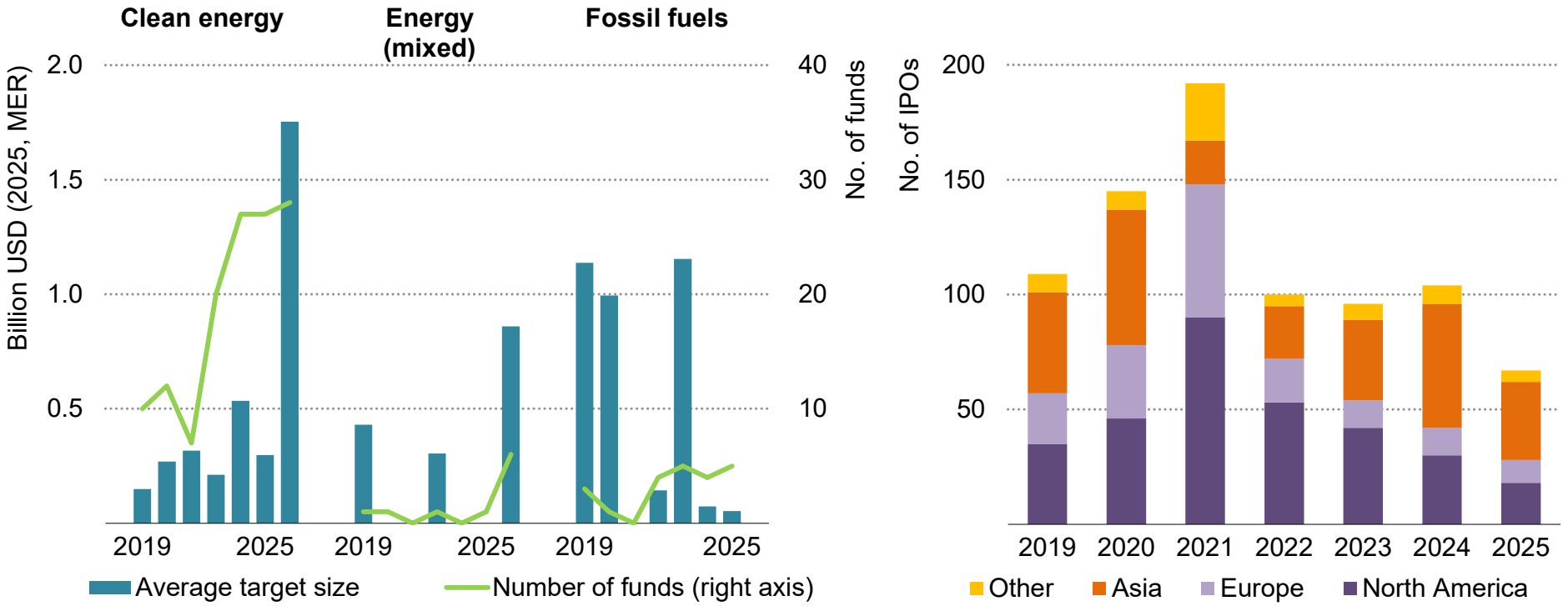
The rise of passive investing has contributed to the decoupling of company-specific fundamentals from capital flows. Energy companies included in major indices – which tend to be large-cap companies listed in developed markets – benefit from persistent inflows regardless of short-term performance or strategic direction. Companies outside of these benchmarks, such as smaller ones including those focused on renewables, may face structurally higher costs of capital and more challenges in accessing it. This problem is most pronounced for EMDE companies that, outside of the larger economies, are unlikely to be listed on stock exchanges or included in funds that are accessible to passive investors.

Finally, the increased presence of institutional investors in SOEs represents a notable shift in the relationship between public and private capital. Many governments have overseen privatisations in recent years, with Argentina launching privatisation of its state-owned utility Energía Argentina in 2025, as part of efforts to improve service and reduce pressure on national budgets.

As governments reduce ownership, they become more exposed to market and investor expectations. This can improve transparency and efficiency, but it may also constrain policy flexibility. The balance between national interests and shareholder returns is therefore becoming more complex, especially in periods of market volatility.

Larger target fund sizes for private-market clean energy funds indicate investor appetite, but higher interest rates and regulatory developments in North America are slowing exit activity

Average energy sector target fund size (left) and initial public offerings (right), 2019-2025



Clean energy funds raised in 2025 had an average target size of USD 1.8 billion, a 10-fold increase from 2019, reflecting strong demand for clean energy asset fundamentals and the growing prevalence of megadeals.

Notes: MER = market exchange rate. IPO = initial public offering. “Energy (mixed)” includes funds investing in both clean energy and fossil fuels across their portfolios. “Other” refers to a sample of more than 30 countries in other parts of the world.

Sources: IEA analysis based on IJGlobal (2026), Infrastructure Transaction database and Crunchbase (2025) database.

Private capital markets continue to show a preference for clean energy-related investments, amid evolving market conditions and challenges surrounding effective capital deployment

Private capital markets have grown significantly in the past years, reaching an estimated USD 15 trillion in assets under management in 2025, and are playing an increasingly important role in financing energy assets and non-listed energy companies. Private capital includes private equity, private credit and real assets (real estate and infrastructure). Most energy-related deals occur within infrastructure funds, which can have a venture capital, equity or credit strategy. Overall, private markets raised roughly USD 2.7 trillion over the past decade for energy-focused funds.

Private market activity slowed between 2023 and 2024, with fundraising falling as higher interest rates affected the leverage ratio of deals and created a valuation gap between buyers and sellers. However, signs of recovery appeared in 2025, particularly for infrastructure funds, which experienced record fundraising of USD 200 billion as growing demand for data centres boosted investor interest. Energy and power accounted for nearly half of deals by infrastructure funds in 2025. The conflict in the Middle East has since slowed fundraising, but infrastructure is expected to remain resilient throughout 2026, with renewed energy security concerns accelerating the deployment of capital already committed to power grids and LNG terminals.

Private market fundraising and dealmaking trends are often heavily influenced by exit activity – the moment at which investors make most of their returns. The most common exit for energy assets is via a sale to an energy company (a strategic sale), with initial public offerings (IPOs) increasingly used outside of Europe and North America. In 2025, fossil fuel and renewables trends diverged, with market developments in North America and valuation mismatches causing a significant slowdown in renewables exits. In the first half of 2025, renewables exits fell by around 80% from the same period in 2024, to USD 2.25 billion; IPOs in the energy sector also fell by around one-third in 2025. Meanwhile, private equity exits for fossil fuel companies in the first half of 2025 alone were equivalent to the 2024 total of USD 19 billion. That said, the impact of the war in the Middle East reduced distributions to investors in the first quarter of 2026, with exit activity across asset classes and sectors falling as sellers contend with rate and valuation volatility.

While this sluggish exit environment for renewables may have slowed dealmaking, it does not reflect the longer-term outlook of private markets. Over the last decade, private market funds have allocated nearly four times more capital to clean energy for every dollar invested in fossil fuels than public market funds (i.e. those that invest in listed stocks and bonds). Last year, the average target size of clean energy funds reached an all-time high at USD 1.7 billion, buoyed by the announcement of several new mega funds.

A key characteristic of private market funds is that they raise capital upfront to invest over a predefined period (generally 5-7 years). Committed capital that has not yet been deployed ("dry powder") in clean energy-focused funds reached USD 92 billion in 2025. This relatively high level of dry powder indicates that investor interest has outpaced deal availability and pressure may mount to deploy capital efficiently in an environment in which returns depend increasingly on operational value creation rather than on leverage. However, it also indicates that a large pool of capital is available to be invested in clean energy technologies in upcoming years.

The recent increase in clean energy activity in private markets also partly reflects the rapid expansion of private credit, i.e. lending provided outside of the traditional banking system by actors such as institutional investors, private credit funds, asset managers and hedge funds. Private credit includes direct corporate lending, unsecured lending (junior debt), capital for balance sheet restructuring (distressed debt) and asset-based finance.

Compared with bank lending, private credit instruments are more flexible and can be structured to align with borrower cash flows and project characteristics. This makes them particularly well suited to smaller clean energy deals (below USD 250 million), for developers seeking to scale up or for projects with non-standard revenue structures that limit access to syndicated loans or public debt markets.

Overall, private debt assets reached USD 3 trillion in 2025, a 50% increase from 2020, filling in the gaps caused by tighter regulation – which has constrained bank lending since the global financial crisis – and by traditional investors pulling back during the pandemic to preserve liquidity. Much of this growth in private credit since the early 2010s has been concentrated in the United States, but rising infrastructure investment and tightening banking regulation (notably with implementation of the Basel IV reforms) are paving the way for greater private credit activity in Europe. For example, in March 2026, Copenhagen Infrastructure Partners' Green Credit Fund II reached a USD 1.3 billion first close, aiming to deploy private credit to finance renewable energy projects and energy-transition corporates, and to refinance existing renewable energy asset portfolios.

However, in 2026, a combination of tighter private credit conditions, notable leveraged loan defaults and investor concerns over lending standards raised questions about the soundness of private credit portfolios. For EMDE renewable energy projects, for which private capital is typically mobilised through DFI-backed blended finance structures, volatility in the private credit market undermines deal viability, as the level of credit enhancement required to crowd in private lenders may outpace the speed at which DFI concessionality can adjust.

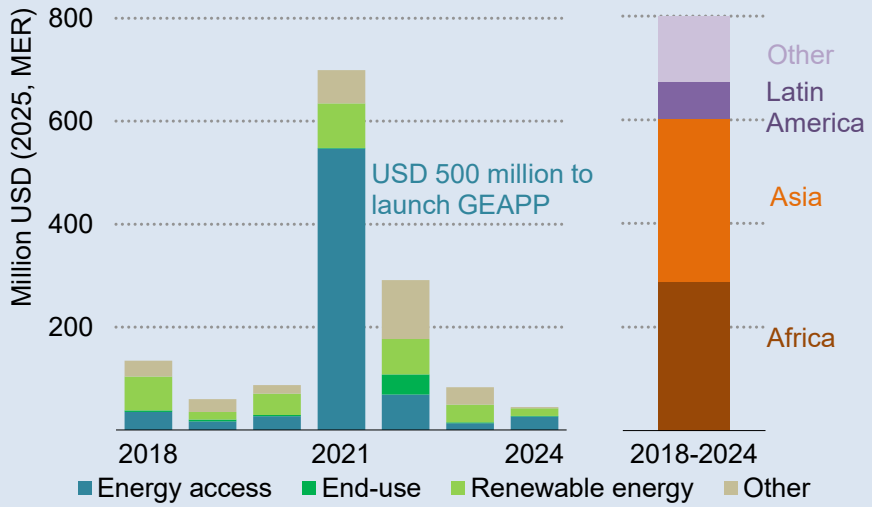
Philanthropies provide a small but crucial share of concessional financing

Philanthropies are receiving renewed attention as catalysts of clean energy investment in the context of declining international public finance. The concessional nature of their capital, given almost entirely in the form of grants, makes philanthropies a key source of capital in underserved markets and riskier sectors. Philanthropies also often fund enabling activities such as capacity building, technical assistance, awareness raising and data collection, helping projects mature and scale up. In 2018-2024, 70% of committed capital included a non-financial component. Despite its importance, the amount of philanthropic capital injected into the energy sector remains modest relative to other sources, with annual commitments averaging USD 200 million between 2018 and 2024, falling below the highs of 2021 and 2022.

Philanthropies vary widely in their mandates, governance structures, risk appetites and funding models, all of which influence the scale and predictability of their financing. Commitments to energy spiked in 2021 to USD 700 million, thanks to a USD 500-million grant to launch the Global Energy Alliance for People and Planet in Africa, from the Rockefeller Foundation, Ikea Foundation and Bezos Earth Fund. Since then, although energy access remains a priority, commitments have fallen dramatically with only USD 45 million committed in 2024, just over half of the 2018-2021 average.

Beyond access, most funding was targeted at mature technologies. Since 2018, over USD 325 million has been committed to renewable energy, particularly solar PV, and around USD 50 million to end-use sectors, notably transport. While the volume may be small compared with public finance, the flexibility and independence of philanthropic capital make it effective at crowding in private financing.

Philanthropies' commitments by sector (left) and region (right), 2018-2024



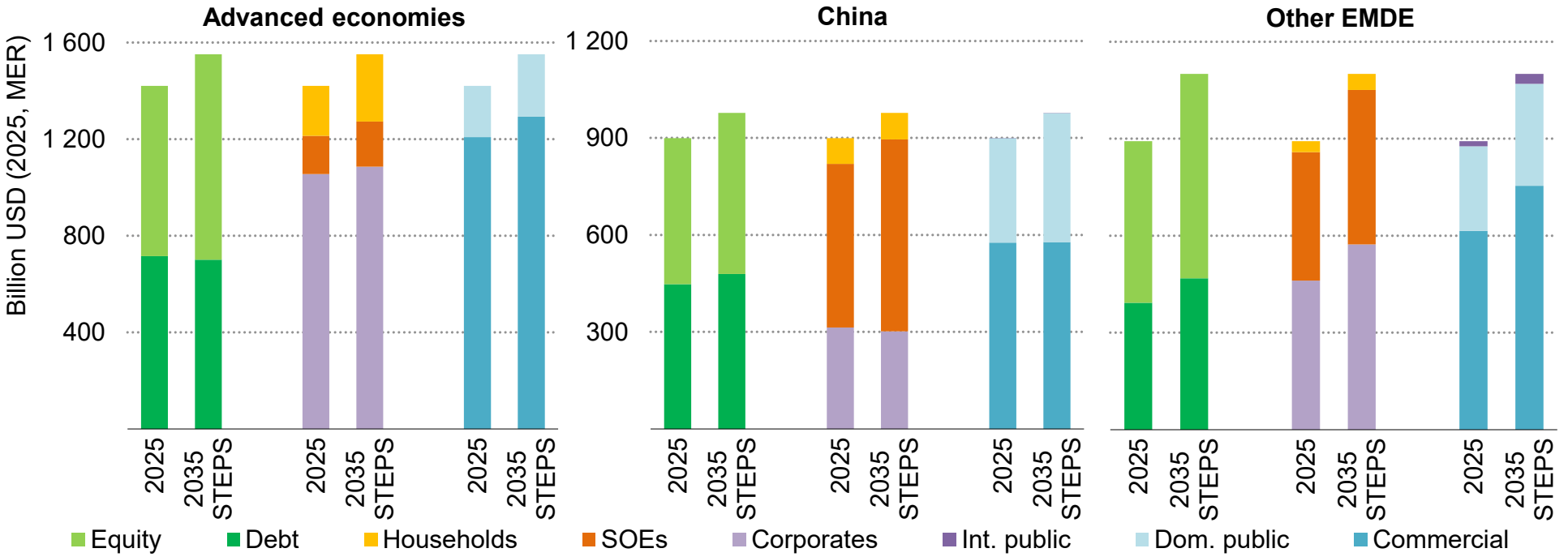
Notes: MER = market exchange rate; GEAPP = Global Energy Alliance for People and Planet. "Other" refers to grids, storage, hydrogen, methane and carbon dioxide removal. For regional definitions see the Methodology Annex.

Source: IEA analysis based on OECD (2025), CRS dataset

Implications

Under the Stated Policies Scenario, all regions see a rise in energy spending over the next ten years, but the growth rate in EMDE is almost double that of advanced economies and China

Energy financing by instrument, investor and financier, 2025 and 2035 STEPS



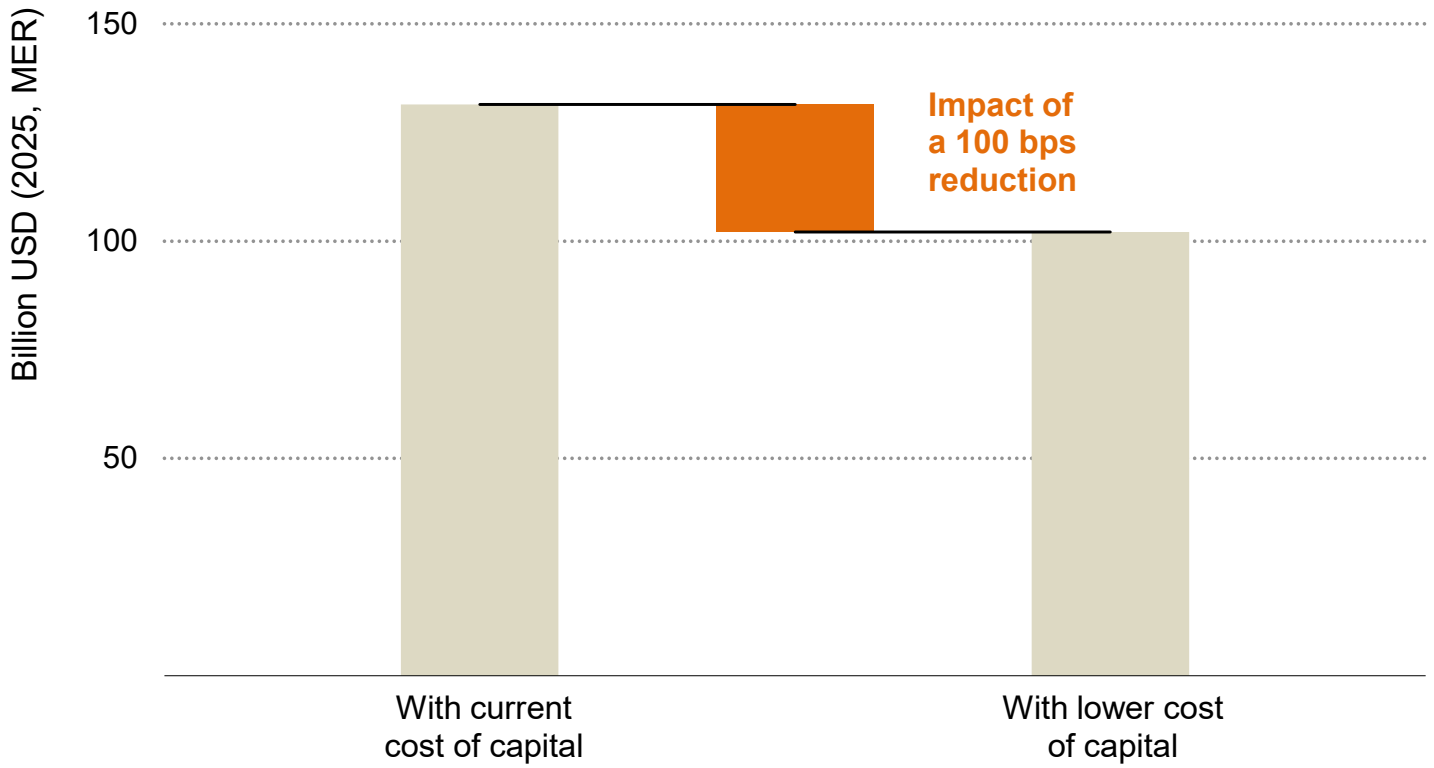
Falling clean-power costs and slower capacity growth in advanced economies and China moderate corporate investment, although it still accounts for 54% of spending in 2035; SOEs and households take on larger shares, mainly for EVs and electricity grids in other EMDE.

Notes: STEPS = Stated Policies Scenario. MER = market exchange rate. EMDE = emerging market and developing economies. SOE = state-owned enterprise. “Int. public” refers to international public finance. “Dom. public” indicates domestic public finance.

Sources: IEA analysis based on S&P Capital IQ (2025) database; IJGlobal (2026), Infrastructure Transaction database; Rystad (2026) database; World Bank (2026), PPI dataset; OECD (2026), CRS dataset; and AidData (2023), Global Chinese Development Finance Dataset version 3.0.

Lowering the cost of capital by one percentage point could reduce average annual EMDE clean power and end-use financing costs in the Stated Policies Scenario by USD 30 billion by 2035

Effect of a reduction in cost of capital on annual average EMDE clean power and end-use financing costs, 2026-2035, STEPS



Implementing targeted policy reforms, deploying derisking instruments and strengthening support from international actors can reduce EMDE financing costs and accelerate the mobilisation of clean energy investment required in the coming decade.

Notes: STEPS = Stated Policies Scenario. MER = market exchange rate. bps = basis points. 100 basis points are equivalent to 1 percentage point.

Energy spending increases roughly 14% in the Stated Policies Scenario in the next decade, requiring efficient capital recycling even though rising capital costs could slow financing

Looking ahead, we used the projections from the IEA's Stated Policies Scenario (STEPS) as illustrative of the general direction of travel for the energy sector, although these projections do not yet incorporate the effects of the current conflict on investor strategies and financing conditions. In this scenario, overall energy spending increases from USD 3.4 trillion today to USD 3.7 trillion in 2035, with the largest expansion in EMDE outside of China.

In both advanced economies and China, drops in fossil fuel spending are more than offset by growth in clean energy sectors. The prominence of grid and end-use spending drives a slight reduction in the role of debt across both regions, although there are diverging developments in terms of capital providers. In advanced economies, despite a slowdown in growth of clean power projects, commercial finance increases marginally, accounting for 82% of spending by 2035, as privately-owned corporates and households increase spending on energy efficiency and electric vehicles. China meanwhile sees growing domestic public finance, primarily through state-owned transmission and distribution companies, whereas the declining cost of renewables and energy storage moderates corporate investments. Within commercial investments, households also take on a bigger role, particularly driven by the take up of electric vehicles.

Outside of China, EMDE spending in fossil fuel sectors increases slightly, but the vast majority of growth is in clean power and end-use sectors. Debt financing therefore becomes marginally more prominent, accounting for under 45% of all energy spending by 2035. Households also begin to play a larger role in energy investment across emerging market and developing economies, accounting for roughly 4% of spending, although this remains behind China (8%) and advanced economies (18%) due to lower average income levels.

Under STEPS, growth in energy spending is achieved through policy environment improvements and continued declines in technology costs. However, financing-cost volatility is a threat: if financing costs remain elevated for a long time following the Middle East crisis, it will not only be harder for projects to achieve bankability, but costs could rise for consumers. This impact would be most pronounced in emerging markets and developing economies, where financing costs are already notably higher than advanced economies and China. In these regions, under STEPS, a combination of the improved policy environment and targeted support from international public finance helps drive a reduction in cost of capital. If the cost of capital is lowered by one percentage point, then financing costs associated with achieving the clean power and end-use investment in STEPS over the next decade would fall by USD 30 billion.

The growing importance of secondary financing

While this report focuses on primary financing, i.e. the capital investment required for new energy assets, it will also be imperative in the long term to monitor trends in the financing of operational assets, or secondary financing. Without any form of capital recycling, sponsor capital can get locked into projects, preventing the development of new projects. Furthermore, secondary financing can offer opportunities to refinance operational assets for cheaper capital, to include a different set of investors with a lower risk appetite, and to free up the most risk-taking capital to reinvest in the development and construction of greenfield projects. This type of capital recycling is common in advanced economies, but fewer equity exit pathways and debt refinancing options in emerging market and developing economies mean that it is often less well established there.

The most common types of secondary market transactions are mergers and acquisitions (M&A); refinancing; and the raising of additional finance for operational needs. In line with trends in primary finance, the secondary market for private capital in infrastructure assets has been gaining strength over the last decade – rising from an estimated USD 220 billion in transactions in 2013 to USD 960 billion in 2023.

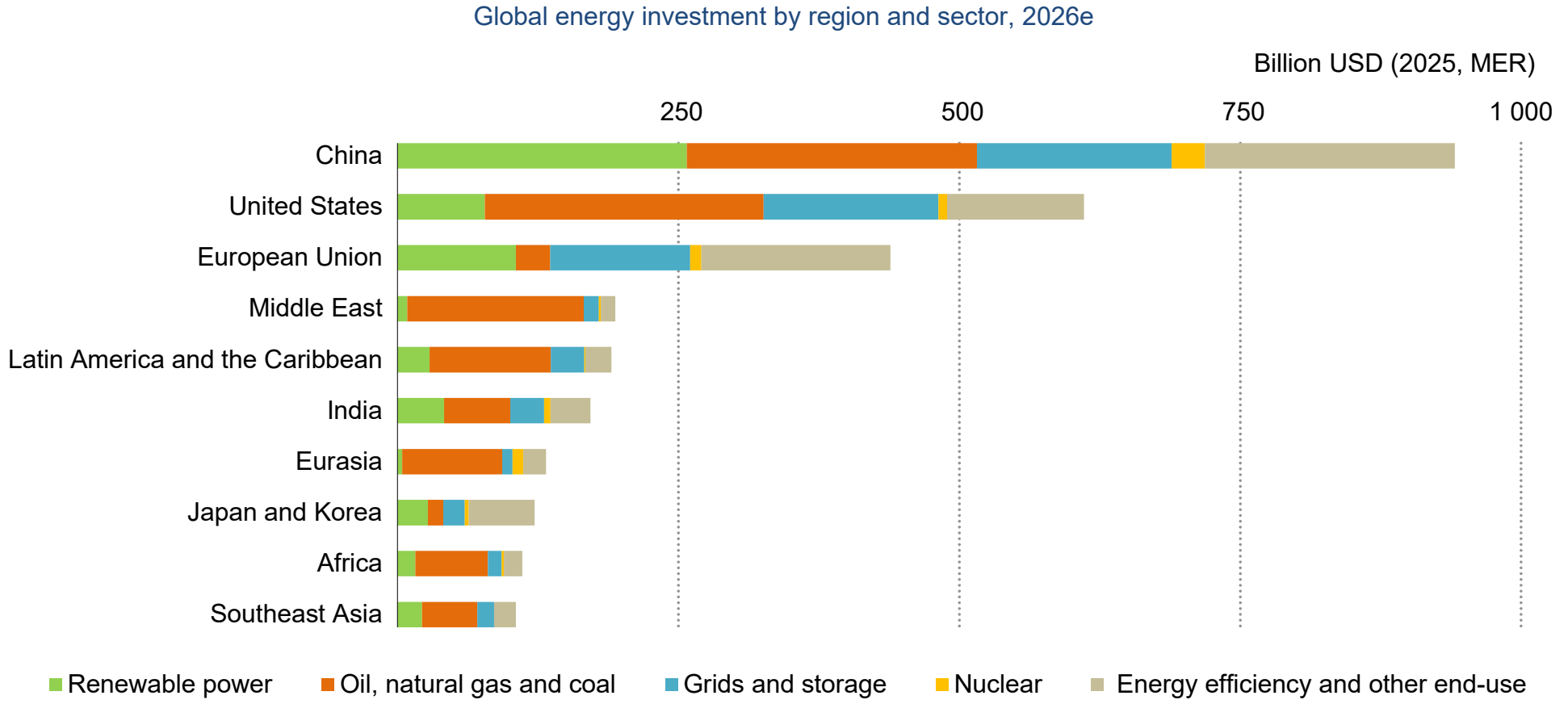
In 2025, M&A activity was generally directed towards larger transactions, offering scaleup and diversification of reliable assets. Within clean energy, the market has shown a growing preference for operational or late-stage-development assets or deals related to grid reliability and AI-driven demand growth. Meanwhile, in oil and gas, consolidation continued with M&A activity led by majors and some of the larger independents. The financial market volatility that began with the Middle East crisis has slowed M&A activity. Acquisitions in the energy sector are generally highly leveraged, making them sensitive to financing costs. Widening credit spreads between February and April therefore rendered transactions less attractive to buyers, which may result in longer recycling periods and added pressure on developers' balance sheets.

In EMDE, the lack of secondary markets can stymie the development of new projects as equity investors do not see viable exit pathways. However, secondary market activity has been growing in EMDE, notably countries with a mix of a maturing asset base and relatively deeper financial markets. For example, India experienced an uptick in clean power M&A activity, including from international private market funds as well as the creation of novel financing instruments, notably infrastructure investment trusts that allow the public listing of a pool of assets.

More funds that focus on acquiring equity stakes in operational or near-operational EMDE assets are also emerging (e.g. Revego in South Africa), providing an important exit pathway for developers while also offering an attractive opportunity for new capital providers with lower risk appetites, such as local pension funds. Without scaling capital recycling, mobilising adequate primary financing for energy transition over the next decade will be significantly constrained.

Regional insights

Global energy sector investment reaches USD 3.4 trillion in 2026

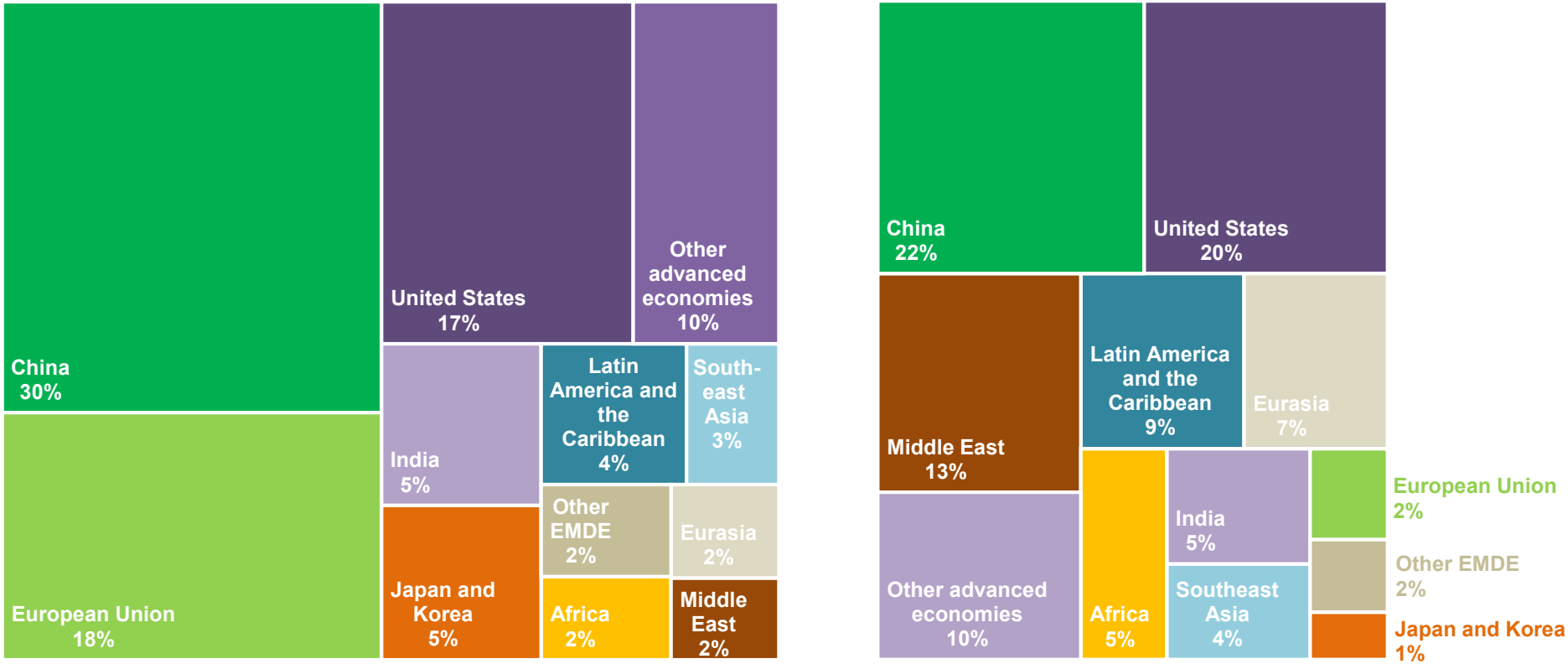


China led energy investment at USD 945 billion, followed by the United States at USD 615 billion and the European Union at USD 440 billion. In most regions, the largest share of investment is directed towards renewable power, grids and storage, and electrification.

Notes: MER = market exchange rate. 2026e = estimated. 2026 investment estimates reflect pre-conflict expectations. For regional definitions, see the Methodology Annex.

In 2026, global investment in clean energy and related infrastructure reaches USD 2.2 trillion, almost double that of fossil fuels

Global clean energy investment (left) and fossil fuel investment (right) by composition and region, 2026e

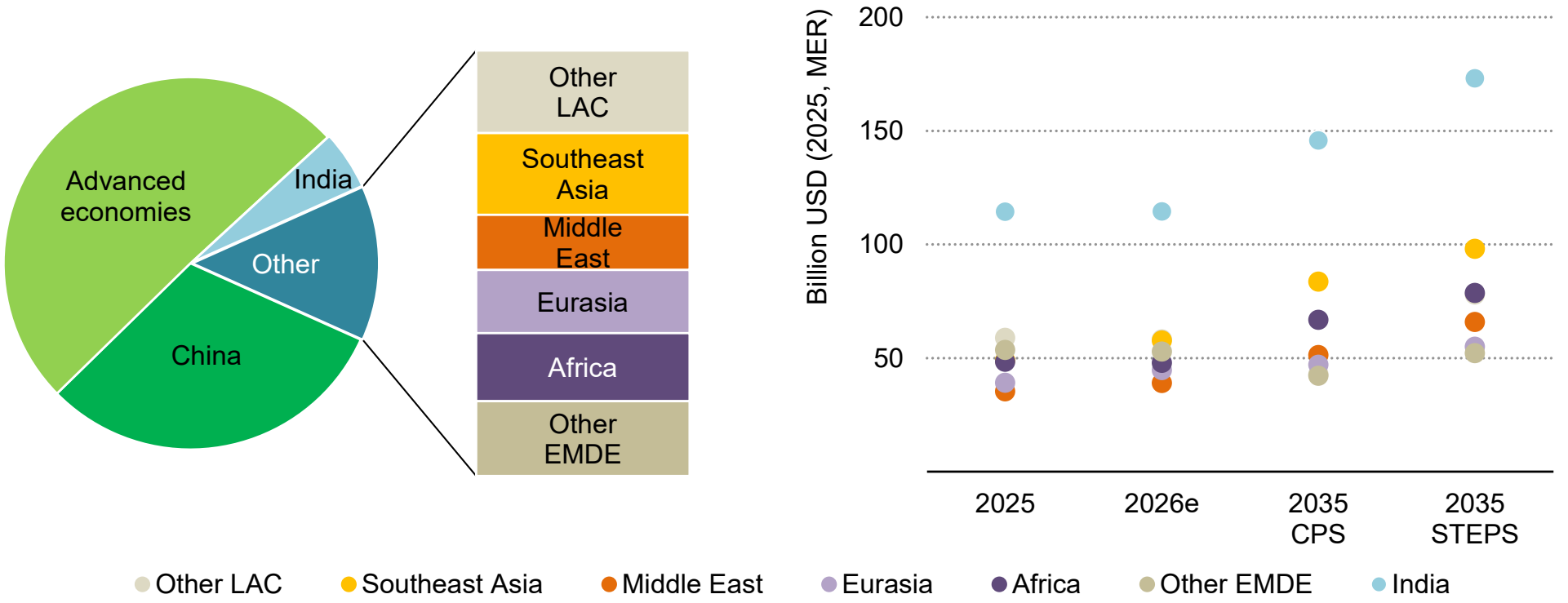


China, the European Union and the United States make up USD 1.5 trillion (66%) of total investment in clean energy. China, the largest investor in fossil fuels, together with the United States and the Middle East, account for total investments of USD 640 billion.

Notes: EMDE = emerging market and developing economies. 2026e = estimated. 2026 investment estimates reflect pre-conflict expectations.

In 2026, EMDE clean energy investment accounts for 50% of the global total

Clean energy investment shares, 2025 (left), and clean energy investment in selected EMDE countries and regions (right), 2015-2035

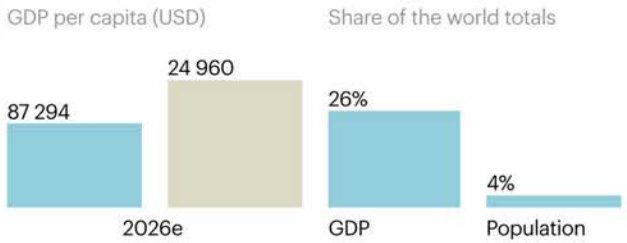


In 2026 investment in clean energy increased by 7% both in advanced economies and in China while by 4% in other EMDE.

Notes: MER = market exchange rate. 2026e = estimated. CPS = Current Policies Scenario. STEPS = Stated Policies Scenario. LAC = Latin America and the Caribbean. "Other LAC" refers to Latin America and the Caribbean excluding Mexico, Chile, Colombia and Costa Rica. EMDE = emerging market and developing economies. 2026 investment estimates reflect pre-conflict expectations. For regional definitions, see the Methodology Annex.

United States

Economic and financial indicators



Sovereign debt rating
AA+

Debt to GDP ratio
120.79 %

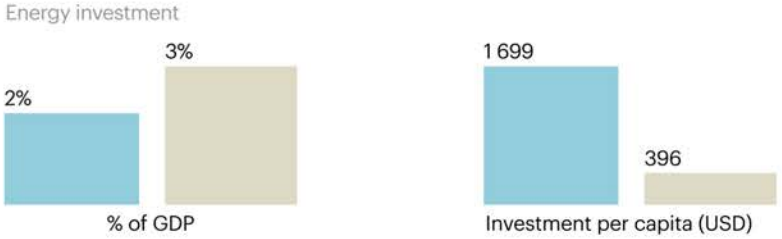
Currency value against USD (2016-26)
N/A

Change in 10-yr gov bond yield since 2020
+243.3 bps

Country risk premium
0.23 %

Change in 10-yr gov bond yield since Mar 2026
+43.1 bps

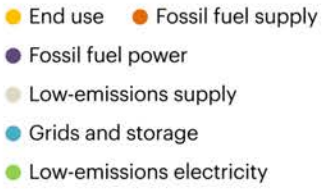
Energy investment indicators

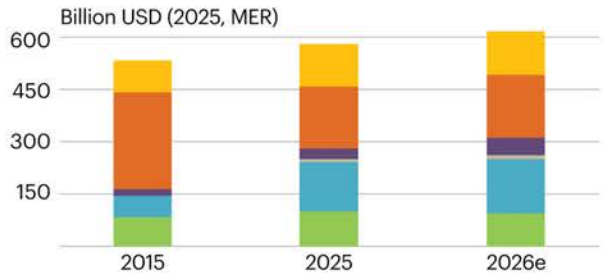


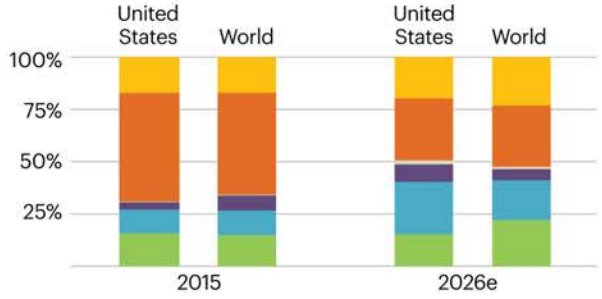
Share of imports from Middle East

Investment share of the world totals

Investment in energy sector





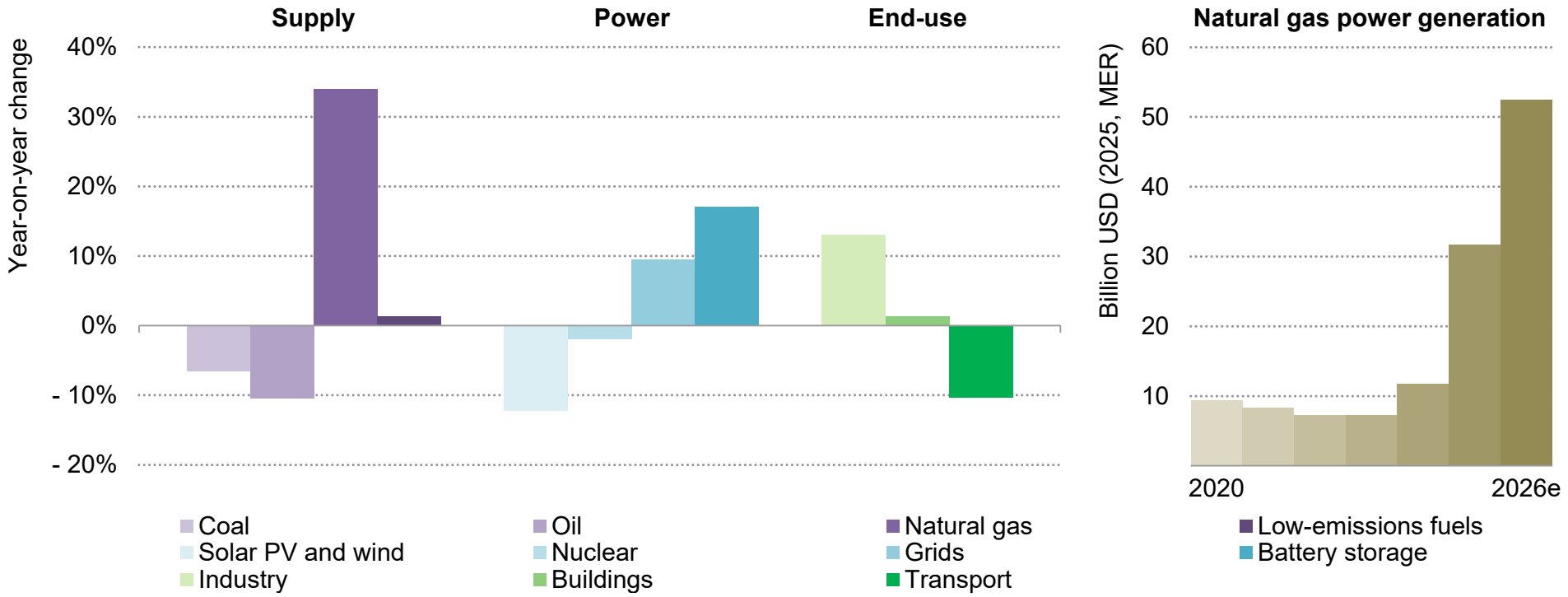


Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares bond yields of January 2020 and March 2026. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

Total energy spending remains steady in the United States, reaching USD 610 billion in 2026

Annual change in investment by sector, 2025 to 2026e (left) and annual investment in natural gas-based power, 2020 to 2026e (right)



Oil investment falls as companies prioritise operational efficiency and returning cash to investors but this is more than offset by natural gas investment increases to support growing LNG capacity. Meanwhile, a surge in investment decisions for natural gas-based generation led investment in fossil-based power to rise by nearly 65%.

Notes: MER = market exchange rate. 2026e = estimated. Fossil fuel-based power includes coal-, oil- and gas-fired thermal power plants.

While policy shifts and tariff evolutions reshape energy spending trends, LNG infrastructure, battery energy storage, geothermal power and grids emerge as investment drivers

The One Big Beautiful Bill Act (OBBBA), which took effect in July 2025, marked a significant turning point for US energy policy. Alongside broad tariffs on energy-related equipment and materials such as solar panels and electric vehicles (EVs), the OBBBA aims to stimulate domestic investment within the energy sector.

Mandated lease sales for oil and gas drilling, as well as incentives for nuclear and geothermal power, seek to ramp up domestic production of energy and related technologies. Power generation investment is set to grow nearly 10% in 2026 to USD 140 billion. Investment in fossil-based power grows by 60%, driven by an increase in natural gas generation to meet rising electricity demand, while total spending on low-emissions power decreases by 6%. Policy shifts lead solar PV investment to fall by one-fifth, though it continues to account for nearly 40% of total spending on power generation. Despite the cancellation of several offshore wind projects, a push to complete onshore projects causes total investment in wind power to rise 8%.

Investment in next-generation geothermal power has risen sharply; today, utilities have procured or announced 11 power purchase agreements (PPAs) totalling about 1 GW. The Department of Energy (DOE) has announced a USD 170 million funding scheme to support next-generation geothermal tests for electricity generation and exploration drilling. Meanwhile, the capital structures of announced geothermal projects are shifting towards greater shares of debt, signalling growing investor confidence as demonstrated by Fervo Energy's USD 1.89 billion initial public offering (IPO).

Data centres are important drivers of innovation for sources of uninterrupted low-emissions power. 10% of nuclear PPAs signed by technology companies today involve small modular reactors (SMRs), and several emerging SMR companies announced oversubscribed venture capital funding rounds at the end of 2025.

Federal mandates for over 30 offshore oil and gas lease sales under the OBBBA are expected to encourage additional fossil fuel supply investment, which is set to reach USD 185 billion in 2026. Bids in the Big Beautiful Gulf (BBG1) auction in December 2025 were, on average, over 30% higher on a per-acre basis than in prior lease auctions in 2023. Overall, oil and gas supply investment is expected to increase marginally by 3% as improved cost efficiencies and capital discipline among producers are balanced with new infrastructure and LNG projects. A nearly fourfold rise in LNG spending in 2026 is driving this increase, and by 2030, the United States will represent nearly half of global LNG export capacity.

The US power sector faces structural shifts in cost allocation and risk mitigation as utilities and grid operators enlarge and improve power grid resiliency

Impacts of wildfires and extreme weather events, such as heat waves and severe storms, are strongly influencing utility and grid operator investment priorities across the United States. In the first half of 2025 alone, extreme weather events led to an estimated USD 131 billion in damage to grids and generation assets. The US DOE is providing support through the Grid Resilience and Innovation Partnership (GRIP), directing around USD 10 billion to projects addressing interconnection, modernisation, and resiliency.

Wildfires are of particular concern to utilities and grid operators, as they risk litigation if power infrastructure contributes to the fire's ignition or spread. Indeed, credit rating agencies such as S&P and Fitch have cited the risk of litigation against utilities and network operators as critical concerns for investors. As a result, utilities in wildfire-prone regions, especially municipal utilities and smaller-scale co-operatives with limited capacities to maintain affordability while scaling up investments, face higher costs of capital.

Meanwhile, 2025 was a record-breaking year for interconnection requests in the United States, driven in large part by data centre capacity additions. In response, some states have opted to implement large-load tariff structures that require data centre projects to cover the cost of a portion of contracted demand, even if usage is lower in practice. For instance, the Dominion Energy GS-5 rate class requires customers requesting at least 25 MW to pay for 85% of contracted transmission and distribution demand and 60% of generation demand, regardless of actual consumption. This limits interconnection queues by discouraging phantom projects while reducing risk to ratepayers from unexpectedly low utilisation rates.

Battery energy storage systems (BESS) were largely spared from the OBBBA-driven phase-out of subsidies and tax incentives for low-emissions technologies. As a result, total BESS spending reached USD 26 billion in 2026, exceeding that year's spending on wind power. Investment is likely to continue growing as both renewable energy developers and large-load consumers choose to co-locate with BESS to improve the reliability of electricity supply.

Taken together, these trends are symptoms of a structural shift in the US power sector. Utilities and grid operators are simultaneously navigating weather-related vulnerabilities (which raise the cost of maintaining existing infrastructure), rapid growth in large loads and increased variable renewable energy (VRE) generation (which increases the need for system flexibility). As a result, operators must balance system resilience, affordability, and flexibility in an increasingly complex grid network.

Latin America

Economic and financial indicators

Sovereign debt rating
CCC- to A+

Debt to GDP ratio
164.27 to 14.95 %

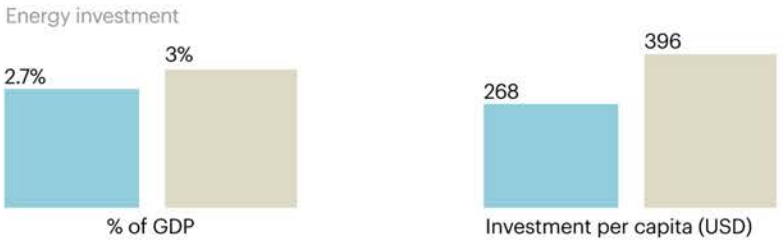
Currency value against USD (2016-26)
68 to -96 %

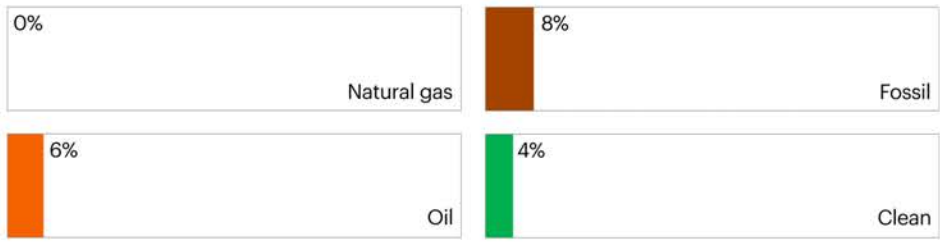
Change in 10-yr gov bond yield since 2020
-611 to +747 bps

Country risk premium
0.78 to 26.66 %

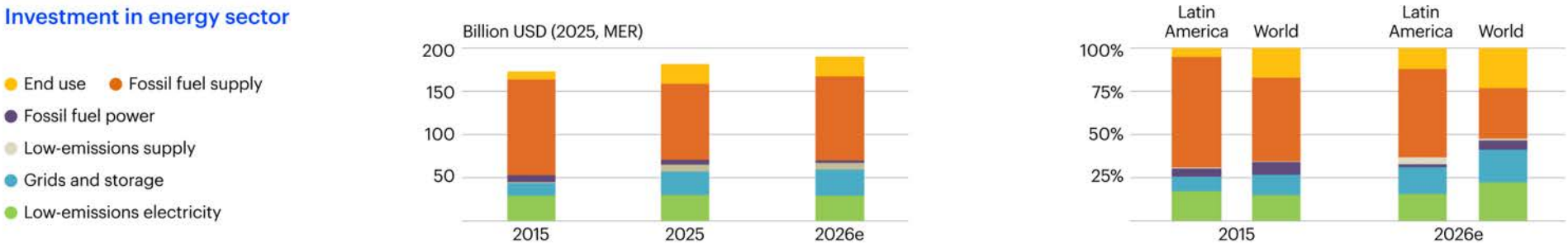
Change in 10-yr gov bond yield since Mar 2026
-29 to +87 bps

Energy investment indicators





Investment in energy sector



Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields for Brazil, Colombia, Chile, Mexico and Peru. Currency data for Venezuela are omitted from analysis on currency depreciation. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

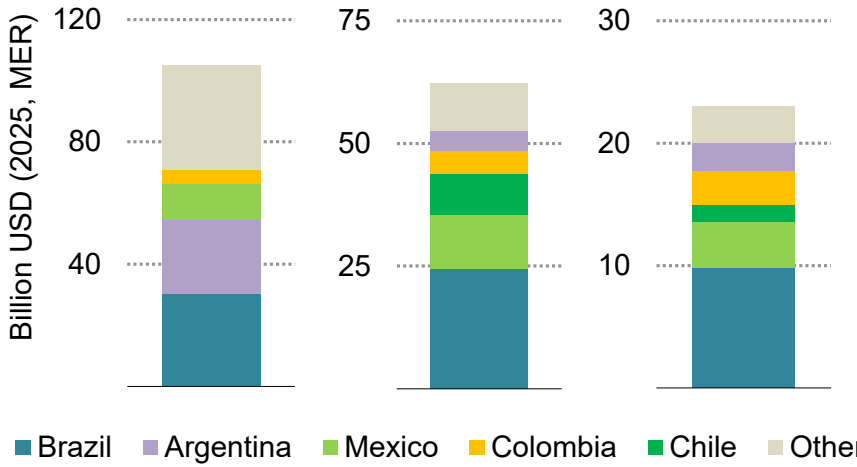
Total Latin America and the Caribbean investments are set to increase by 5% in 2026, with fossil fuel supply spending continuing to rise to over USD 100 billion

Latin America and the Caribbean see some distinctive trends in energy investment. Renewables account for 63% of the region's power generation, compared with 33% globally, reflecting traditional strengths in hydropower as well as policy momentum and improving market conditions for clean energy deployment. Investment in clean energy across the region has risen to over USD 90 billion (a 4% increase), with solar and wind making up 60% of new capacity additions.

Modern bioenergy investment totals just over USD 2 billion, a 15% decrease since 2025, covering nearly 85% of total bioenergy use, used for cooking and light industrial manufacturing. Brazil's Fuel of the Future Law has mobilised around USD 4 billion in announced commitments while the União da Indústria de Cana-de-Açúcar e Bioenergia has signalled investments of USD 26 billion in ethanol, biomethane and sustainable aviation fuel. However, nearly 70 million people continue to rely on traditional biomass, underscoring needed targeted policy interventions and investment to close gaps in clean-cooking access.

The mining sector is undergoing rapid development to address growing concerns over high supply-chain concentration and is supported by government-backed financing, such as Argentina's Incentive Regime for Large Investments (RIGI) that has accumulated just under USD 35 billion worth in projects. Foreign investment is accelerating, with the United States investing USD 1 billion in the region since January 2025 and the International Finance Corporation committing a USD 400-million loan to a USD 2.5-billion lithium project in Argentina and considering an investment in Brazil.

Supply, power and end-use investments in the region, 2026e



Notes: MER = market exchange rate. 2026e = estimated. LAC = Latin America and the Caribbean.

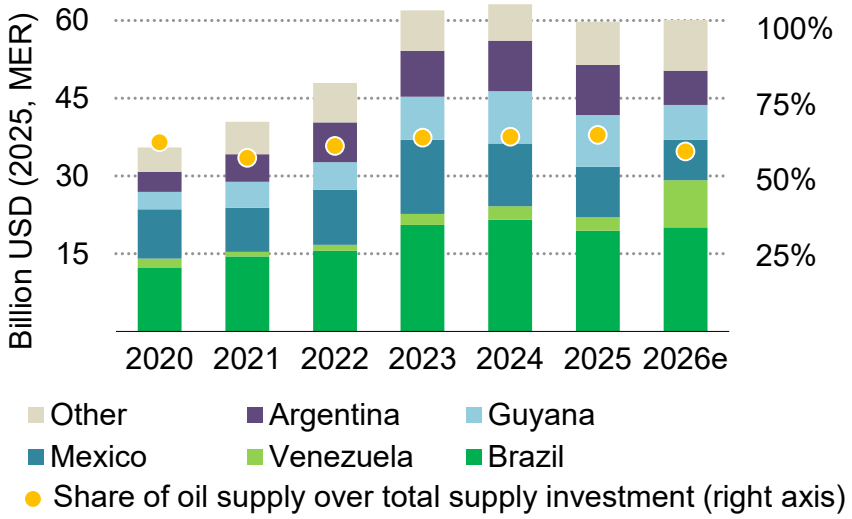
Capital investments in oil supply reach USD 77 billion, with Brazil, Mexico and Venezuela leading the sector and new projects approved in Argentina, Guyana and Suriname

Supply investments have consistently exceeded USD 95 billion annually since 2023, largely owing to deepwater developments in Brazil and Guyana. Oil investments – which averaged USD 77 billion per year during 2023-2026 – dominate the region's supply sector, accounting for roughly 77% of total supply investments. The region's upstream oil and natural gas spending has shot up 40% since 2019, from about USD 55 billion to USD 75 billion. For tight oil and shale gas, upstream investment is USD 10 billion in 2026, with Argentina scaling up production in the Vaca Muerta shale formation, supported by a joint development agreement between Eni, YPF and XRG.

Overall, the region's upstream oil investments remain predominantly private, with roughly 70% of total spending in 2026, consistent with previous years. However variances exist, public-sector participation is pronounced in Argentina, Mexico and Brazil, where investments are led primarily by state-owned Petrobras, with capital expenditures reaching close to USD 20 billion in 2025. Mexico and Ecuador, both longstanding producers, are registering historic lows in output, accompanied by a 10-20% decline in investment, bringing their combined annual spending to roughly USD 10 billion. Meanwhile, Argentina, Brazil and Guyana have reached record production levels.

Looking ahead, significant recent discoveries in Brazil, Guyana and Colombia, coupled with strong licensing activity, are expected to underpin upstream growth, with planned offshore-exploration drilling in Suriname, and Trinidad and Tobago opening a competitive bid for the largest auction of oil and gas exploration in the country's history. Increased investment in Venezuela reflects the impact of amendments to the Ley de Reforma Parcial de la Ley Orgánica de Hidrocarburos that will give companies greater certainty, although the impact on production will take time to be felt.

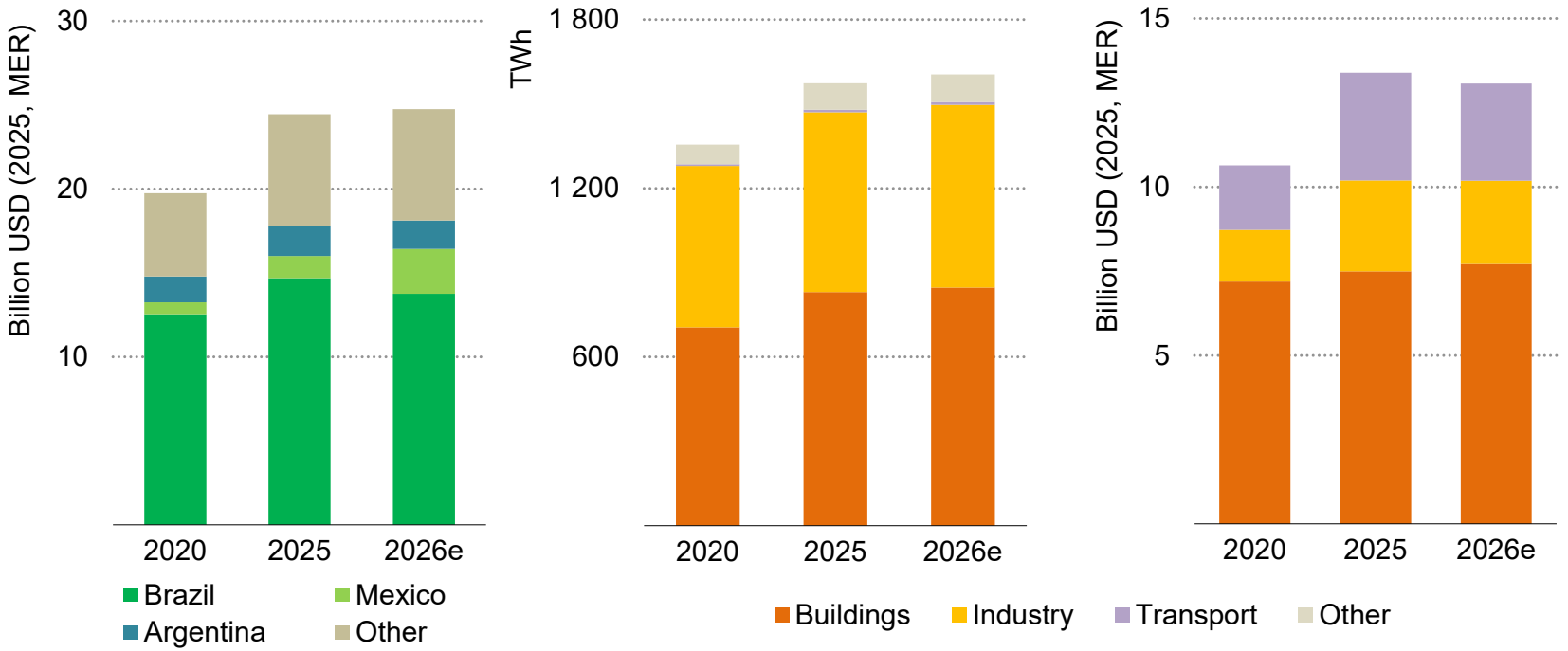
Oil investments by selected country and region, 2020-2026e



Notes: MER = market exchange rate. 2026e = estimated. LAC = Latin America and Caribbean. "

Grid investments rise 25% from 2020 to roughly USD 25 billion, helping the power sector meet increasing electricity demand and improve reliability

Grid investments by region (left), electricity demand (centre) and energy efficiency investments by sector (right), 2020-2026e

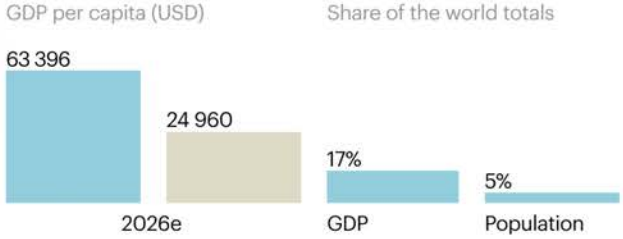


The industry and buildings sectors are responsible for much of the 87% increase in electricity demand since 2020, while energy efficiency investments have risen 23% since 2020 to USD 13 billion, supported by policies and private investment.

Notes: MER = market exchange rate. 2026e = estimated.

European Union

Economic and financial indicators



Sovereign debt rating
BBB- to AAA

Currency value against USD (2016-26)
18 %

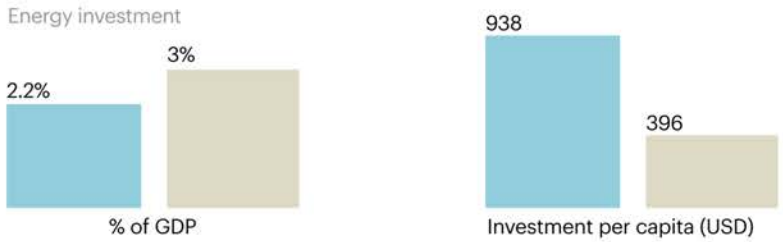
Country risk premium
0 to 2.85 %

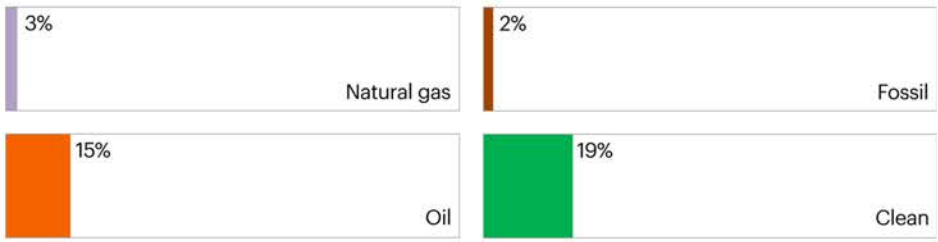
Debt to GDP ratio
150.89 to 23.62 %

Change in 10-yr gov bond yield since 2020
+307.9 bps

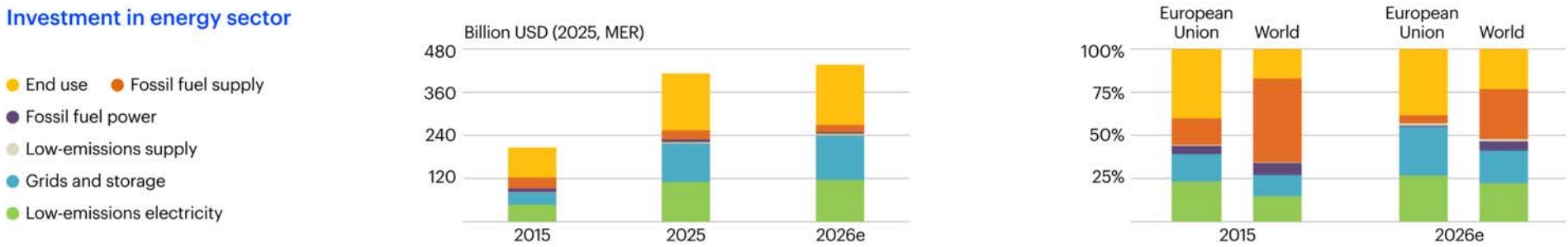
Change in 10-yr gov bond yield since Mar 2026
+39.2 bps

Energy investment indicators





Investment in energy sector



Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

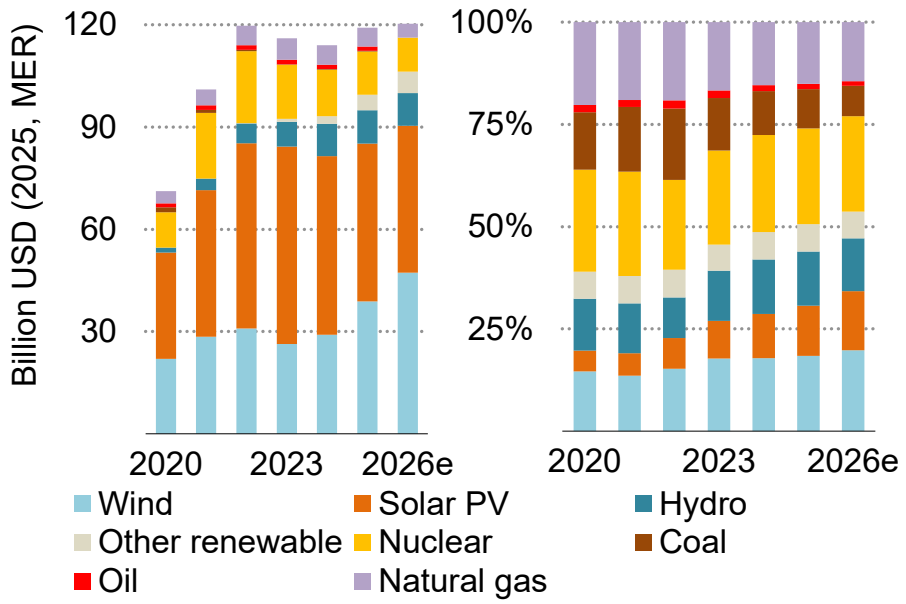
Renewable energy investments rose 7% last year in response to energy security concerns, supported by policies to encourage clean energy development and electrification

Since 2020, the European Union has rapidly increased its rollout of clean energy technologies while reducing reliance on fossil fuels. Investment in renewable power generation has almost doubled to over USD 105 billion, with anticipated spending on clean energy sources almost 30 times higher than for fossil fuels in 2026. The European Commission has launched a Clean Energy Investment Strategy in partnership with the European Investment Bank (EIB) to finance almost USD 90 billion in clean energy projects over the next three years.

Solar PV and onshore wind industry growth remains stable: prices are falling and capacity additions are growing, with investment expected to reach USD 75 billion in 2026. In contrast, the offshore wind sector has faced challenges, with some auctions failing to attract bidders, requiring a rethink of support mechanisms. However, in January 2026 governments from nine countries, transmission system operators (TSOs) and industries signed an Investment Pact for the North Seas, committing to build 15 GW of offshore wind capacity per year during 2031-2040. This will derisk offshore wind investments, mobilising an anticipated USD 1.2 trillion of economic activity and investing just over USD 11 billion in supply chain capacities by 2030.

From a consumer perspective, vehicle preferences are clearly shifting away from internal combustion engines (ICEs) towards EVs. In 2025, battery electric vehicles (BEVs) made up almost 20% of total new vehicle registrations. Meanwhile, the share of ICE registrations continues to decline, with gasoline vehicles losing 7% and diesel 2%. This consumer behaviour contrasts with the EU policy announcement easing the 2035 vehicle fleet emissions target from a 100% to a 90% reduction.

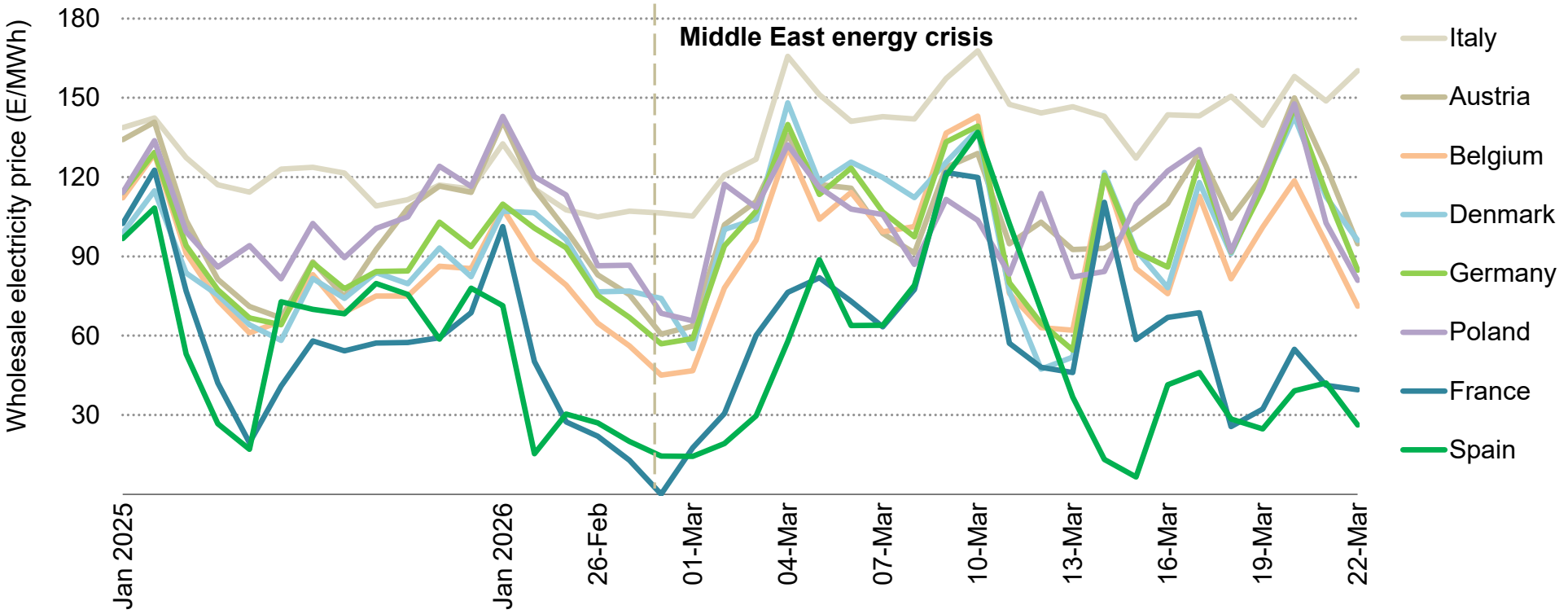
Investment by generation source (left) and electricity generation by source (right), 2020-2026e



Notes: MER = market exchange rate. 2026e = estimated.

Energy mix and market configuration differences cause uneven price exposure across EU

EU wholesale electricity prices, monthly from Jan 2025 to 24 Feb 2026; daily from 25 Feb 2026



Average wholesale electricity prices in March 2026 were around EUR 47/MWh in Spain and France, which rely more on renewables and nuclear, but almost three times higher elsewhere, showing how reducing exposure to fuel-price volatility helps affordability.

Source: IEA analysis based on ENTSO-E (2026), Transparency platform.

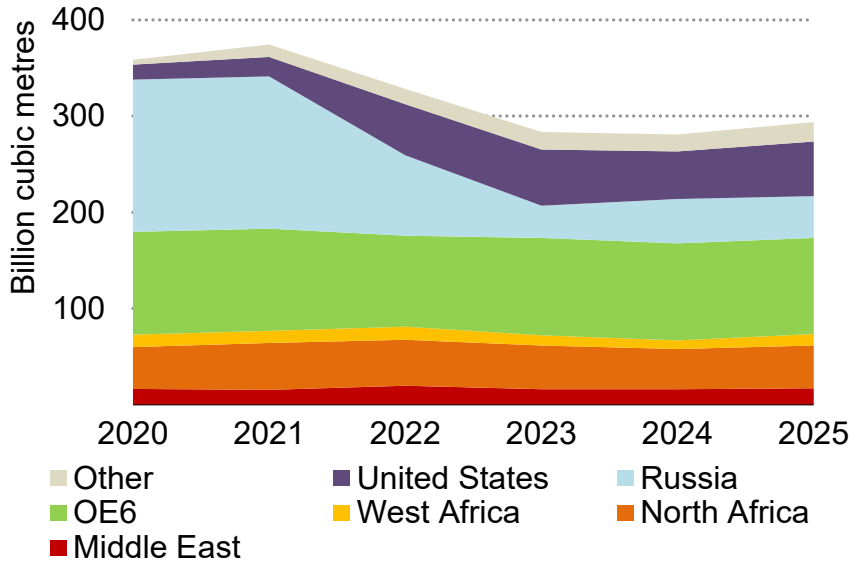
Affordability and energy security lie at the core of the EU strategy for a competitive energy system, supported by resource diversification and accelerated electrification

As a strategic EU priority, the region is pursuing energy security by diversifying fuel suppliers, reducing overall fossil fuel demand, and accelerating electrification and renewable energy deployment. The European Union reduced its share of Russian natural gas imports from 42% in 2021 to 15% in 2025 and has agreed to ban gas imports from the Russian Federation from 2027. Since 2022, diversifying natural gas imports has been a key priority, with volumes from the United States and Africa increasing by around 30%. LNG has led this shift, thanks to natural gas infrastructure investments rising from USD 9 billion to USD 17 billion in 2025.

The priority attached to electrification is reflected in higher investments in battery storage, which are set to reach almost USD 13 billion in 2026, a 30-fold increase from 2020, and USD 110 billion for transmission and distribution, a more than doubling over the same period. The Commission has allocated almost USD 2 billion to the Battery Booster Facility and up to USD 590 million to the European Grids Package. Grid reinforcement and expansion remain at the centre of national energy planning discussions, with Spain targeting USD 13 billion by 2030, France's Réseau de Transport d'Électricité (RTE) planning USD 117 billion to 2040, and Italy's Terna designating USD 27 billion to 2034. Meanwhile, Germany foresees USD 420 billion in transmission grid investments by 2045.

Volatility in European energy prices has reinforced the need to ensure that the energy transition remains economically sustainable for households and industry. As a result, some countries have announced tax reductions on energy products, such as lower value-added tax (VAT), or a cap on retail fuel prices, and lowered taxes on electricity to encourage the push for a more electrified energy system.

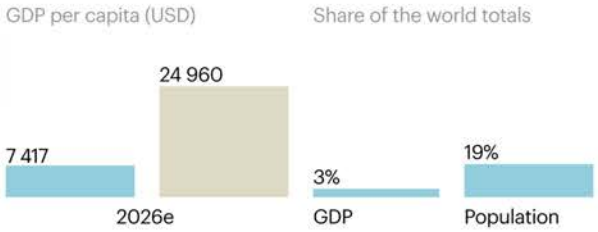
EU natural gas imports by region of origin, 2020-2025



Note: OE6 = Iceland, Israel, Norway, Switzerland, Türkiye and United Kingdom.

Africa

Economic and financial indicators



Sovereign debt rating
SD to BBB

Currency value against USD (2016-26)
38 to -99 %

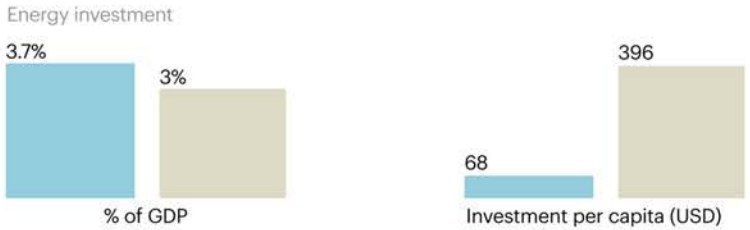
Country risk premium
2.07 to 12.95 %

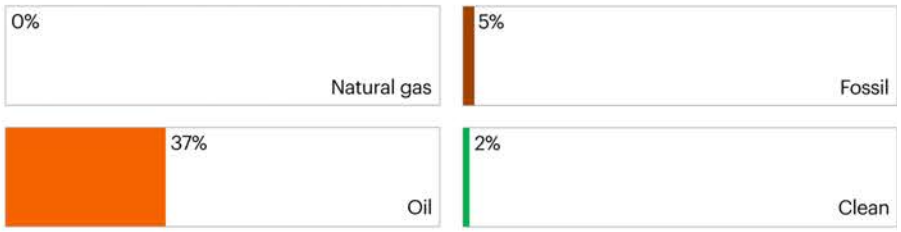
Debt to GDP ratio
271.98 to 19.31 %

Change in 10-yr gov bond yield since 2020
-1 563 to -61 bps

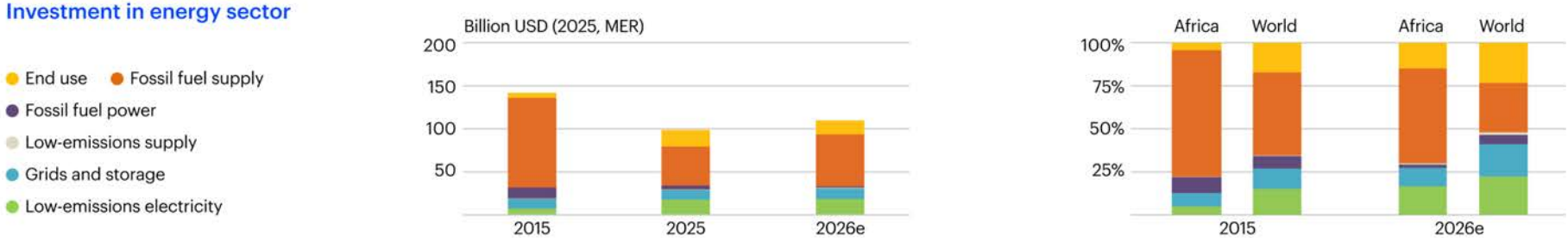
Change in 10-yr gov bond yield since Mar 2026
-69 to +81 bps

Energy investment indicators





Investment in energy sector



Notes: bps = basis points. 2026e = estimated. SD = selective default. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields for Zambia and South Africa. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

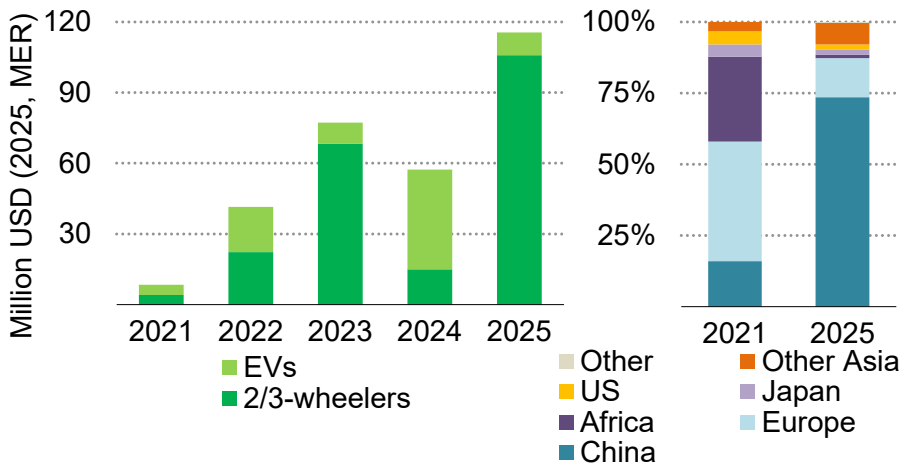
Fossil fuels continue to dominate energy investment in Africa, although power generation and transport needs are attracting new technologies to the mix

Africa's energy investments are set to grow 11% in 2026 to USD 110 billion, reflecting strong increases in fossil fuel supply. Nonetheless, they still account for only 3% of the global total, even though the continent is home to 20% of the world's population. Access gaps remain significant, with 590 million people lacking access to electricity and around 1 billion to clean cooking. Fossil fuels dominate investment, but spending on clean energy grew 17% between 2024 and 2025 and is expected to reach almost USD 50 billion in 2026. Investment in low-emissions generation (primarily nuclear and solar PV) has been expanding to account for 90% of total generation investments in 2026, a 3.5-times increase from a decade ago.

Despite representing a small share of total spending, EV investment increased by 50% between 2024 and 2025 and is on track to triple in 2026, with the EV fleet growing from 4 000 in 2020 to 130 000 in 2025. Governments in East Africa are positioning themselves as leaders of this transition, with Ethiopia's effective ban on ICE car imports, Kenya's VAT exemption on e-buses and e-motorcycles and Rwanda's ban on new-ICE motorcycle taxis in the capital highlighting the momentum behind broader local EV adoption.

In 2025, African e-mobility companies sparked investor interest, with venture capital providing USD 115 million in startup funding, more than double the average of the last four years. Much of this growth is concentrated among companies producing commercial vehicles and two- and three-wheelers, which have scaled up rapidly. Along with locally produced EVs, imports into African markets have increased rapidly. In 2025, 70% of total imports came from China, up from 16% in 2021, underscoring the diminishing role of EU exporters and the growing dominance of Asian suppliers in Africa's electric mobility supply chain.

Venture capital investment in African startups (left) and EV imports by region of origin (right), 2021-2025



Notes: MER = market exchange rate. "Other Asia" refers to South Korea and Southeast Asia. "Other" refers to Mexico and India.
Source: IEA analysis based on Cleantech (accessed 22 April 2026).

Capital allocation in Africa's upstream oil and gas sector shifts towards higher-risk projects, with growing investment in emerging producers despite limited current output

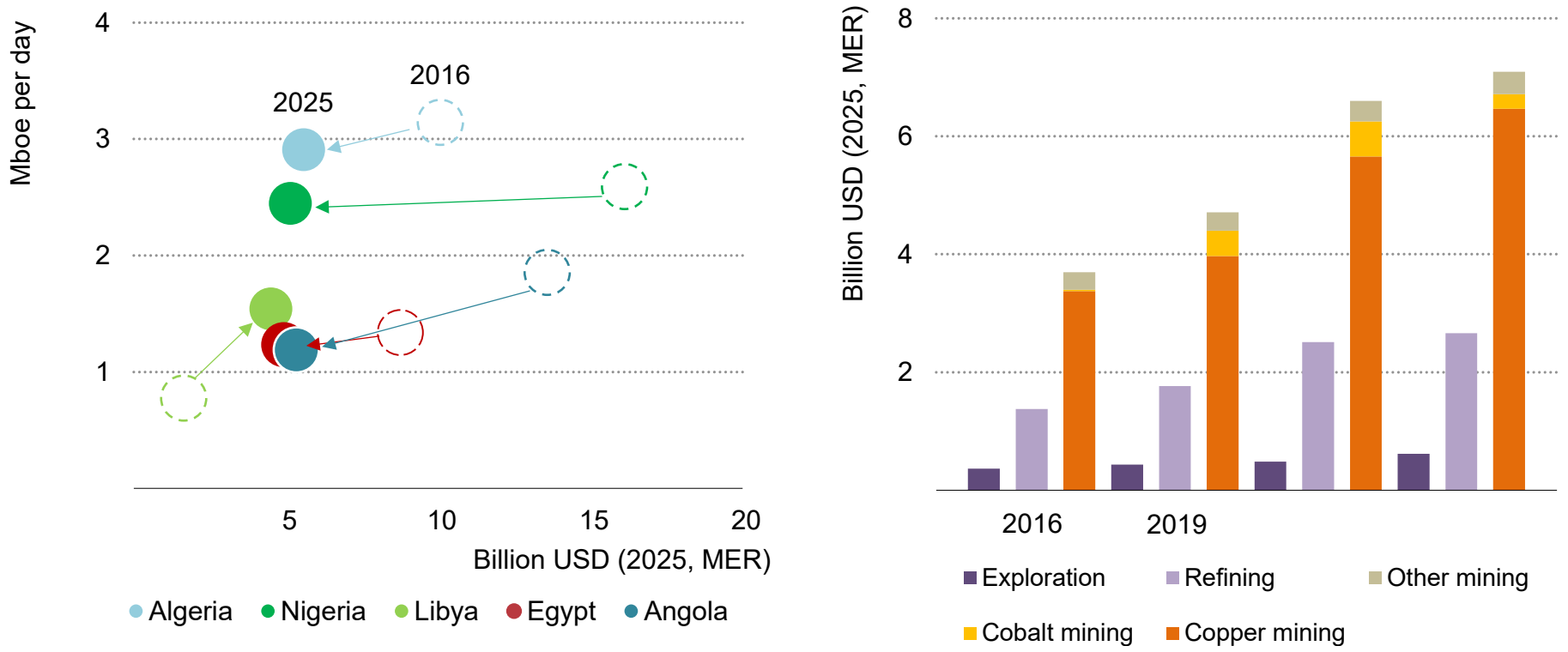
Upstream investment in Africa reached USD 37 billion in 2025, down from USD 68 billion in 2016. In the past decade, the continent's upstream sector has shown diverging trends between established producers and emerging suppliers. Investment in the region remains highly concentrated with five countries – Algeria, Angola, Egypt, Nigeria and Libya – accounting for 70% of investment and 80% of production. However, total investment across these producers has halved from USD 50 billion in 2016 to USD 25 billion in 2025, despite an increase in Libya, reflecting shifts in investment competitiveness. In contrast, capital allocated to emerging producers has seen an uptick since 2016. For instance, investment in Mozambique, Namibia, Senegal and Uganda has risen from USD 1.5 billion in 2016 to USD 5 billion in 2025 despite limited current production. This reflects fewer opportunities to invest in mature assets and the development of new capital-intensive projects (particularly deepwater and LNG terminals), resulting in higher investment requirements relative to current output.

Exploration capex in Africa reached almost USD 6.5 billion in 2025 reflecting ongoing work across recent discoveries. Given that the average global rate of commercial success is 27%, exploration is inherently risky, with national oil companies (NOCs) taking on a greater role. However, constrained government budgets in several producer countries can limit the ability of NOCs to fund upstream investment, raising reliance on partnerships and alternative financing arrangements, as seen in Mozambique and Senegal. Overall, private and international oil companies remain the primary drivers of Africa's upstream spending, reflecting the sector's ongoing dependence on external capital, technology and project execution capacity, while NOCs account for about one-quarter of total capex, in line with historic levels.

Along with oil and gas investment, spending on critical minerals has been growing, with Africa's share of global investment rising from 14% to 19% over the past decade. Greenfield mining spending has doubled – from about USD 3.5 billion in 2016 to just over USD 7 billion in 2024. Most of this growth – over 90% – has focused on copper, particularly in the Democratic Republic of the Congo, Morocco and Zambia. Lithium mining investment reached USD 28 million in 2024, a 2.5 times increase compared to 2023 levels. Since 2023, 13 African countries have imposed export bans on critical minerals in an attempt to increase local processing and move up the value chain. However, despite new projects emerging, investment in refining shows only mild growth in the past decade, reaching USD 2.5 billion in 2024. Water scarcity, electricity shortages as well as a lack of infrastructure and human capital are preventing the region from capturing a larger share of downstream value.

Declining investment across key oil and gas producers shows a shift in competitiveness as critical minerals spending continues to expand, led by mining

Upstream investment and production in selected countries (left) and investment in critical minerals in Africa (right), 2016-2025

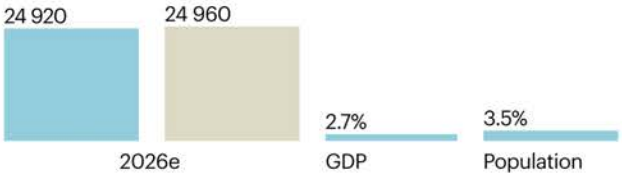


While oil and gas investment has declined 50% for most key producers since 2016,
Libya's capital spending and output have almost tripled over the past decade as the country recovered from civil war.

Notes: mboe/d = million barrels of oil equivalent per day. Upstream investments include upstream oil and gas development expenditures only. "Other mining" includes lithium, rare earth elements and nickel. "Refining" includes lithium, cobalt, nickel, graphite, copper and rare earth elements. Critical minerals investment considers only overnight greenfield investment, calculated based on capital intensities by region in 2024 dollars, collected from S&P and company reports, applied to production additions. MER = market exchange rate.

Middle East

Economic and financial indicators



Sovereign debt rating

SD to AA

Currency value against USD (2016-26)

3 to -10 %

Country risk premium

0.64 to 26.66 %

Debt to GDP ratio

134.01 to 3.04 %

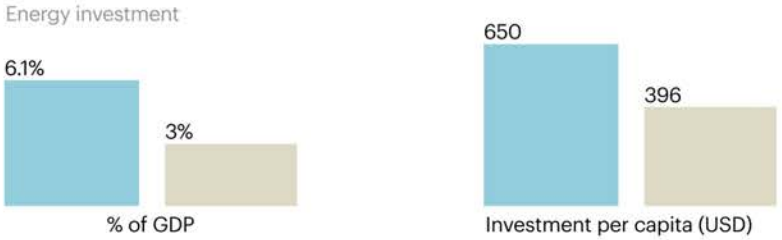
Change in 10-yr gov bond yield since 2020

No data

Change in 10-yr gov bond yield since Mar 2026

No data

Energy investment indicators



Share of imports from Middle East

N/A — Natural gas

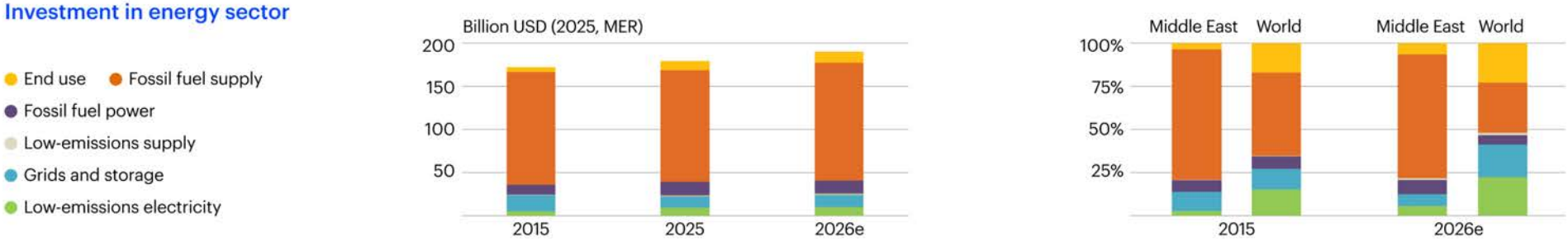
N/A — Oil

Investment share of the world totals

13% — Fossil

2% — Clean

Investment in energy sector



Notes: bps = basis points. SD = selective default. 2026e = estimated. 2026 investment estimates reflect pre-conflict expectations. There are no data on government bond yields. The currencies of Jordan, Saudi Arabia, Qatar and the United Arab Emirates are pegged to USD.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

The current conflict raises questions and uncertainties for future energy investments in the Middle East, a mainstay of global energy supply

The conflict in the Middle East is raising major questions about trends and priorities for the region's energy investment. Gulf producers have been key for global energy supply, but the reliability of these supplies have been questioned by the blockage to transit through the Strait of Hormuz. Even though many countries' oilfield activity has been impacted by the conflict, ongoing spending for operational support continues, which, alongside supply chain inflation, translates into cost overruns and a rise in 2027 investment rather than a large reduction in 2026 spending. We estimate that upstream oil and gas investment in the region will therefore fall by around 1% in 2026.

Saudi Aramco's Q1 2026 revenue increased year-on-year and capex guidance remained steady. However, regional year-on-year earnings of major oilfield service providers fell (in part due to conflict-related impacts). SLB and Halliburton both cited 13% decreases in their Middle East and Asia revenues, while Baker Hughes was down 19% in the Middle East. This partly reflects disruption-induced delays to planned expenditures. In the case of upstream fields, most curtailed supply could be restored relatively quickly once the security situation allows. An estimated 50% of Gulf country upstream fields likely have sufficient reservoir pressure and fluid characteristics to return to pre-conflict levels within approximately two weeks, rising to 80% around one month later. This is contingent upon the security situation in each country, the ability of companies to mobilise skilled labour and contractors, and the normalisation of supply chains, all of which could significantly constrain the return to pre-conflict production rates. The remaining 20% of fields face more complex restart challenges.

Exporters that have invested in alternative routes to market have been best able to weather the storm, notably via Saudi Arabia's East-West pipeline to the Red Sea and the United Arab Emirates pipeline to Fujairah. The conflict is already spurring new regional pipeline discussions as other exporters seek to reduce their reliance on the Strait, but the necessary financing and political arrangements remain open. Capital spending will also need to be directed to repairing damaged facilities. As of early May, our assessment is that over 30 facilities have been either moderately or severely damaged, including refineries, petrochemical plants, and upstream oil and gas production sites. In Qatar, 2 of the 14 liquefaction trains at the Ras Laffan LNG production facility experienced Iranian missile strikes. Therefore, even if the Strait of Hormuz were to reopen, around 17 bcm/yr would be unable to return to the market, resulting in annual revenue losses of USD 5.5 to 7.5 billion. The actual time and cost of repairs will depend heavily on the extent of the damage, repair scope, execution strategy and pressure on supply chains during a period of heavy global investment in LNG.

Fossil fuel supply has historically dominated across the region, but the age of electricity is arriving in the Middle East

Fossil fuel supply has traditionally dominated the investment equation in much of the Middle East, but electricity issues have been quickly rising to the top of the regional agenda. Fossil fuels remain the backbone of the region's power sector, but there has been a push in many countries to displace oil use with natural gas and to bring in low-emissions generation, including renewables and nuclear.

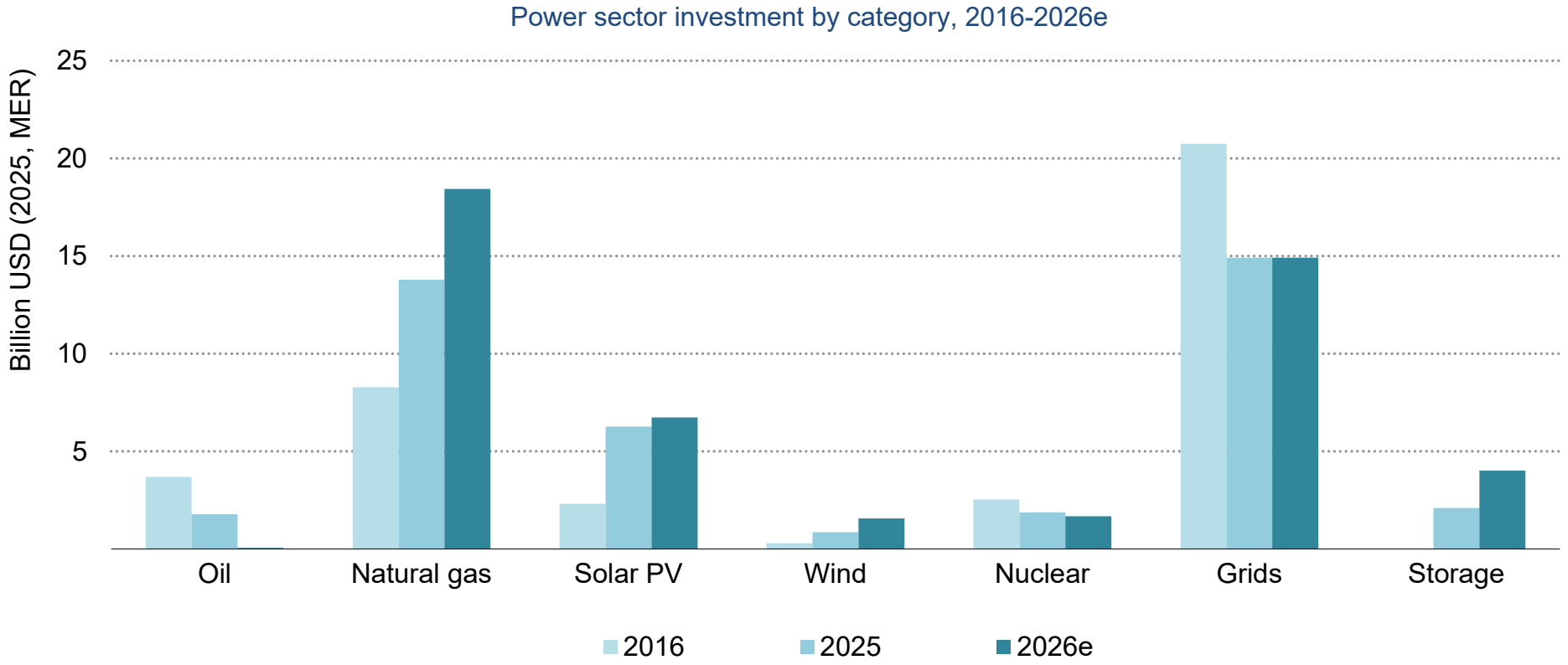
Natural gas dominates the region's power mix, providing 70% of electricity. Dependence on gas is especially high in Bahrain, Oman and Qatar, where it fuels over 95% of electricity generation. However, spending on low-emissions generation rose 70% in the last decade, with utility-scale solar PV investment increasing five-fold and wind investment nearly tripling, largely owing to countries in the Gulf Cooperation Council (GCC).

GCC countries have invested over USD 42 billion to develop 62 GW of renewable energy projects. Much of this growth is anchored in large utility-scale investments backed by state procurement and national economic transition strategies. For instance, Saudi Arabia's ACWA Power, Badeel and Saudi Aramco Power Company (SAPCO) invested over USD 8 billion in seven solar and wind projects totalling 15 GW under the National Renewable Energy Programme. In other parts of the region, distributed and rooftop solar has grown rapidly, to reduce reliance on expensive diesel generators. In Lebanon, some estimates state that off-grid systems may now make up as much as one-third of total installed capacity.

Electricity demand has more than tripled since 2000 with a rise in incomes and population growth of twice the global average, plus mounting consumption for household appliances, desalination and space cooling, of which residential space cooling accounts for more than 240 TWh, a four-fold increase since 2000. To maintain the reliability of grids, investment in transmission and distribution are set to reach USD 10 billion in 2026, a 35% increase compared to 2020. In parallel, investment in battery storage also surges to USD 3.5 billion, highlighting the importance of energy storage as a strategic linchpin of the region, with Saudi Arabia signing the world's largest grid-scale energy storage projects with BYD and Masdar starting the construction of USD 5.9 billion battery project in UAE.

Investment in the end-use sector has doubled in the last 10 years, up to just over USD 10 billion in 2025 and set to reach new heights of almost USD 15 billion in 2026. The increase has been mainly driven by the buildings and transport sectors, increasing two-fold and almost four-fold respectively. Energy efficiency investment dominates the end-use sector, achieving almost USD 10 billion, accounting for around 70% of the total end-use investment.

Amid huge uncertainty, natural gas and low-emissions technologies are driving investment trends in the Middle East power sector

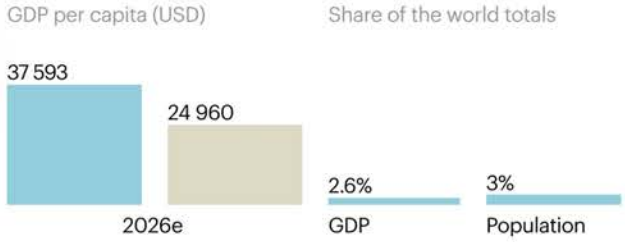


Electricity demand in the Middle East has grown 35% in the last decade, reflecting rising consumption for household appliances and desalination. Solar PV investment has increased five-fold in the last decade.

Notes: MER = market exchange rate. 2026e = estimated. Natural gas refers to unabated natural gas. 2026 investment estimates reflect pre-conflict expectations.

Eurasia

Economic and financial indicators



Sovereign debt rating
B to BBB-

Currency value against USD (2016-26)
23 to -33 %

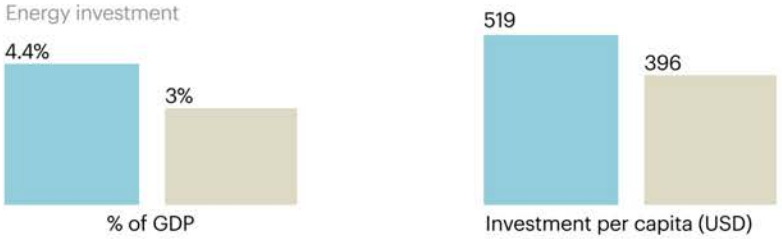
Country risk premium
2.07 to 8.41 %

Debt to GDP ratio
50.3 to 4.62 %

Change in 10-yr gov bond yield since 2020
+971.5 bps

Change in 10-yr gov bond yield since Mar 2026
No data

Energy investment indicators



Share of imports from Middle East

N/A
Natural gas

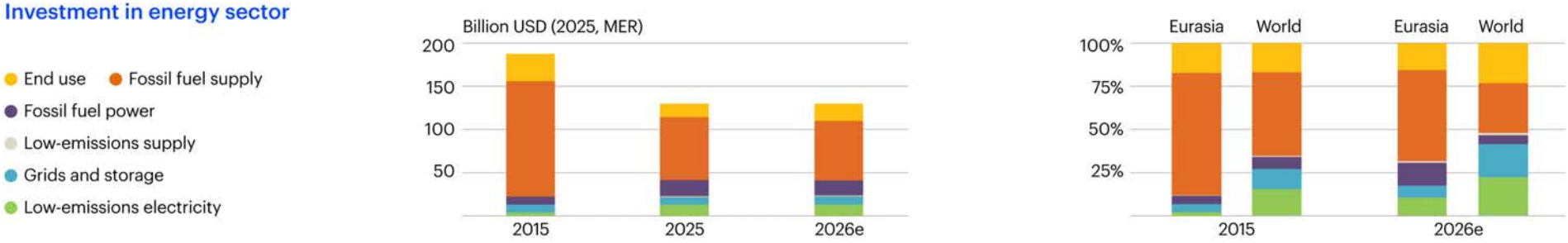
N/A
Oil

Investment share of the world totals

7%
Fossil

2%
Clean

Investment in energy sector

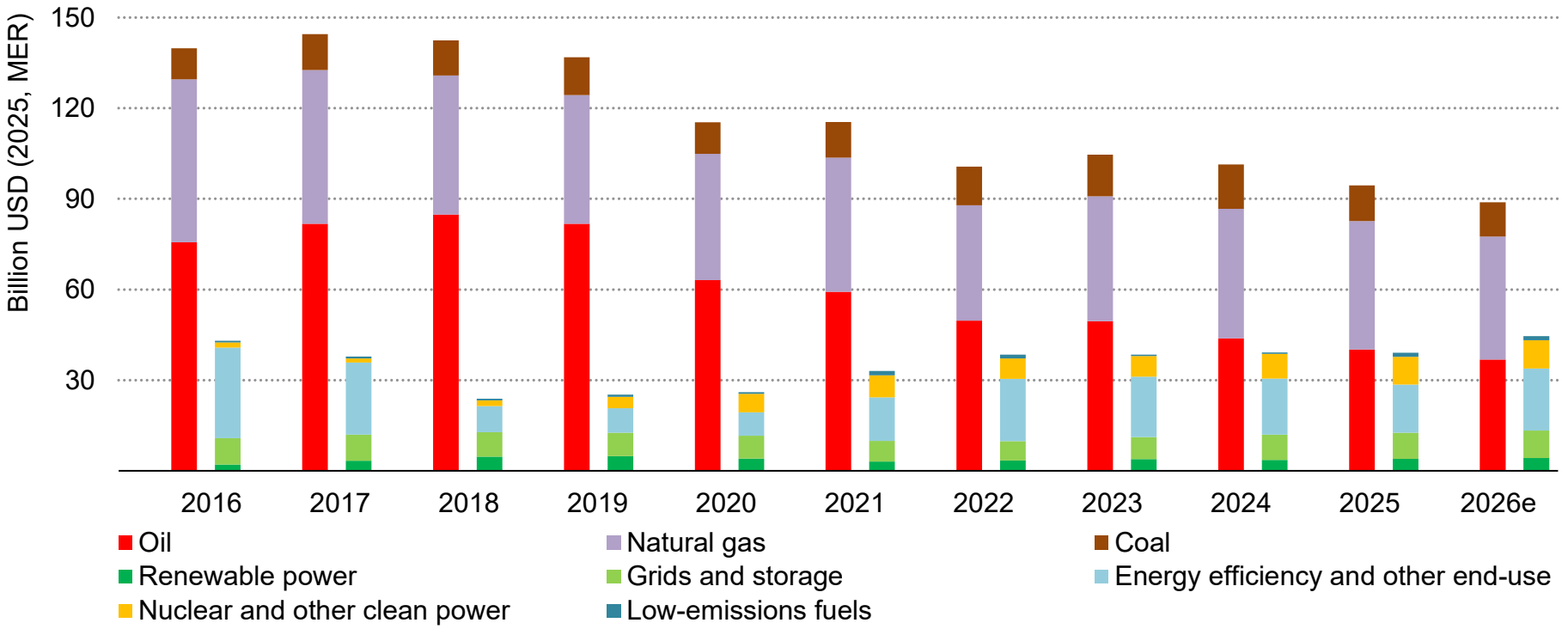


Notes: bps = basis points. 2026e = estimated. 2026 investment estimates reflect pre-conflict expectations. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields for Russia. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

Fossil fuels remain dominant in Eurasia's energy mix, while renewable power, grid investment and end-use electrification reached record highs over the last decade

Energy investments by major category in Eurasia, 2015-2026e



Fossil fuel investments reached a decade low as oil investments halved and gas investments fell by almost one-quarter, while natural gas investments edged up from 2016 levels.

Notes: MER = market exchange rate. 2026e = estimated. "Other clean power" refers to fossil-fuelled power with carbon capture, utilisation and storage (CCUS), hydrogen, ammonia and large-scale heat pumps. "Low-emissions fuels" are modern bioenergy, low-emissions hydrogen-based fuels and CCUS associated with fossil fuels, including direct air capture.

Energy security imperatives and geopolitical pressures are steering investment towards power system reliability, resilience and diversification

While fossil fuels continue to dominate both energy supply and investment, new geopolitical pressures and technology opportunities are reshaping investment priorities in Eurasia. Total investment in Eurasia is set to reach almost USD 135 billion in 2026, with two-thirds for fossil fuels. However, the composition of spending is beginning to shift towards maintaining and increasing the reliability of existing infrastructure, strengthening export resilience and reducing exposure to single suppliers and transit routes.

Russia's role in EU gas supply has declined significantly, with its share falling from 41% in 2021 to around 15% in 2025. Nevertheless, over 75% of Eurasian upstream oil and gas investment is still made by Russia, even though projected regional upstream oil and gas capital expenditures for 2026 amount to less than USD 50 billion – roughly half the 2016 level. Russia's loss of most of the European gas market has forced a reorientation towards Asia, including a renewed focus on co-operation with Central Asia. However, uncertainty around the Power of Siberia 2 project that would link Russia's West Siberian resource base with China underlines the challenges of redirecting pipeline gas exports at scale, despite China's willingness for the project to proceed.

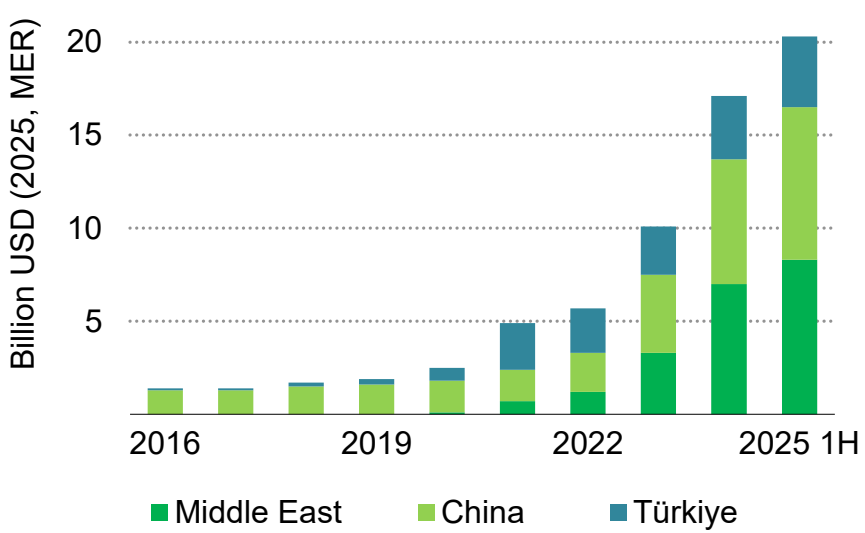
In the Caspian and Central Asia region, system reliability, grid expansion and export resilience are becoming more important components of regional investment. For instance, Kazakhstan has launched a 2025-2029 modernisation programme with planned investment of over USD 27 billion across generation and grid infrastructure. In June 2025, Kazakhstan and China signed a USD 3.7-billion energy deal for a 1 000-MW solar plant, a transformer plant and a 1 320-MW coal plant in the Almaty region. Furthermore, TotalEnergies has announced plans to invest USD 1.2 billion in a major wind power and battery storage project.

In June 2025, Azerbaijan strengthened its role in gas supply with approval of the USD 2.9-billion Shah Deniz Compression project to extend field life and support additional exports through the Southern Gas Corridor. Plus, given Europe's goal of diversifying its gas supply, Azerbaijan is examining the potential of expanding the Southern Gas Corridor. Uzbekistan is also emerging as the main destination for new foreign direct investment (FDI) in energy in Central Asia. Major recent power projects in Uzbekistan include a USD 350-million 500-MW solar plant in Namangan, a USD 1.2-billion 1-GW wind project by Sany Renewable in Karakalpakstan, and a USD 1.55-billion 1 500-MW wind-plus-storage project by ACWA Power in Karakalpakstan; it has also attracted roughly USD 2 billion in Chinese solar investment. Furthermore, Uzbekistan reported that it had become a net exporter of electricity in 2025 and plans to supply up to 2.6 billion kWh to neighbouring countries.

FDI stock in the Eurasian power sector increased almost fifteen-fold between 2016 and the first half of 2025, driven by rising electricity demand and rapid renewable energy project expansion

Power-sector FDI stock in Central Asia climbed to just over USD 20 billion by the first half of 2025, while Kyrgyzstan's 1 880 MW Kambarata-1 project, developed jointly with Kazakhstan and Uzbekistan and supported by the World Bank, underlines the growing role of cross-border hydropower infrastructure in the project pipeline. Turkmenistan remains more focused on gas, with the China National Petroleum Corporation (CNPC) Bagtyyarlyk project accounting for USD 9.4 billion of Chinese investment. Critical minerals are emerging as a separate investment area in Eurasia. In Kazakhstan, a USD 1.1-billion joint venture agreed in November 2025 between Cove Capital and state-owned Tau-Ken Samruk will develop the Northern Katpar and Upper Kairakty tungsten deposit. FDI stock from Asian countries in the Eurasian region reached almost USD 120 billion in the first half of 2025. China was the largest funding source, accounting for 55% of the total, followed by the Middle East at 20% and Türkiye at 15.5%. Extractive industries, power and manufacturing together made up around 85% of domestically directed FDI stock. Investment composition has shifted in the past decade, with the share of extractive industries declining from 55% in 2016 to 35% in the first half of 2025, while the power sector portion swelled from 2.6% to 26%. Power sector investment doubled in the first half of 2025 to around USD 20 billion compared with 2023, reflecting rising electricity demand and the expansion of renewable projects. The Middle East was the primary source of new power sector investment, contributing around USD 1.2 billion in 2022 and raising its power sector FDI stock to USD 8.3 billion, slightly above China's USD 8.2 billion.

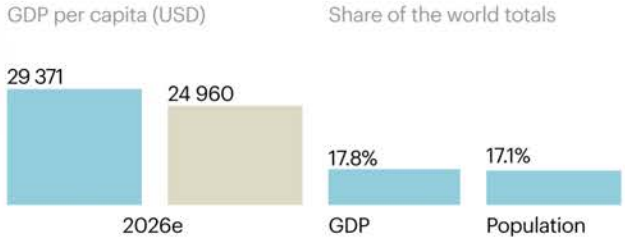
FDI stock by major economies, 2016-2025



Notes: FDI = foreign direct investment. MER = market exchange rate. 1H = first half.
Source: IEA analysis based on data from the Eurasian Development Bank (2026), Investment Inflows into the Eurasian Region from Asian Countries in 2024-2025 (Accessed on 3 May 2026).

China

Economic and financial indicators



Sovereign debt rating
B to BBB-

Currency value against USD (2016-26)
23 to -33 %

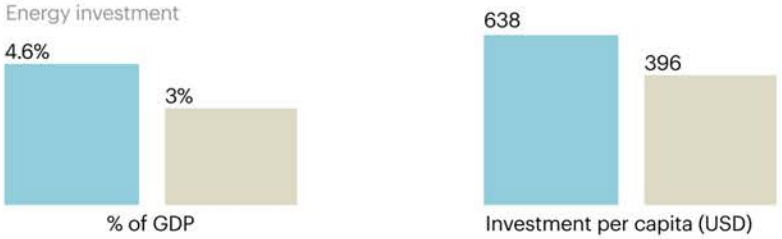
Country risk premium
2.07 to 8.41 %

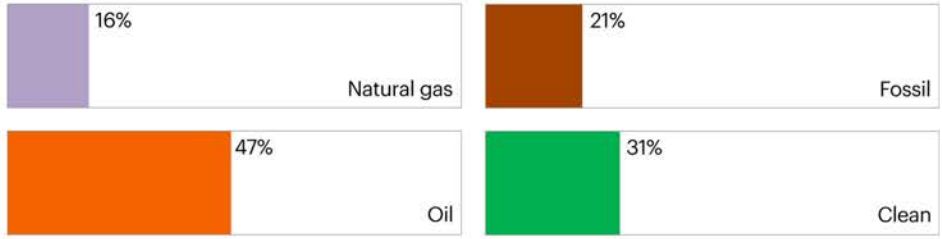
Debt to GDP ratio
50.3 to 4.62 %

Change in 10-yr gov bond yield since 2020
+971.5 bps

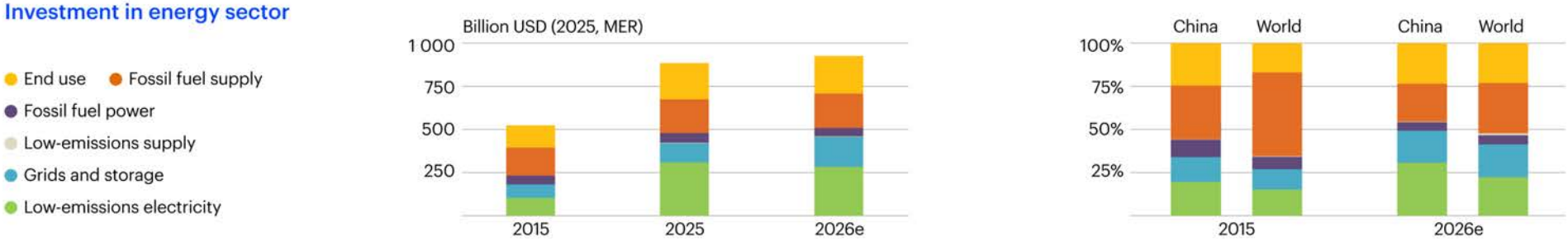
Change in 10-yr gov bond yield since Mar 2026
No data

Energy investment indicators





Investment in energy sector



Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

China's energy investment priorities shift from capacity expansion to system strategy ahead of its 15th Five-Year Plan Period

China is beginning to implement its 15th Five-Year Plan (2026-2030) at a time when energy investment drivers are evolving. After a decade of rapid growth, policy attention is shifting from sheer expansion to energy system quality and co-ordination. Clean energy deployment remains central, but it is now embedded within a broader strategy for industrial upgrading, innovation and the development of "new-quality productive forces" as traditional economic engines such as real estate lose impetus.

A key structural change shaping investment decisions is the shift from the long-standing "dual control" framework on energy consumption and intensity to one that places carbon emissions and efficiency at the core of project governance. New guidance put this transition into practice, strengthening carbon- and efficiency-based requirements in investment approvals, standards and financing. By focusing on carbon intensity and total emissions rather than on energy volumes alone, the framework tightens discipline over high-emissions projects while allowing greater flexibility for economic restructuring, reinforcing the objective of peaking before 2030.

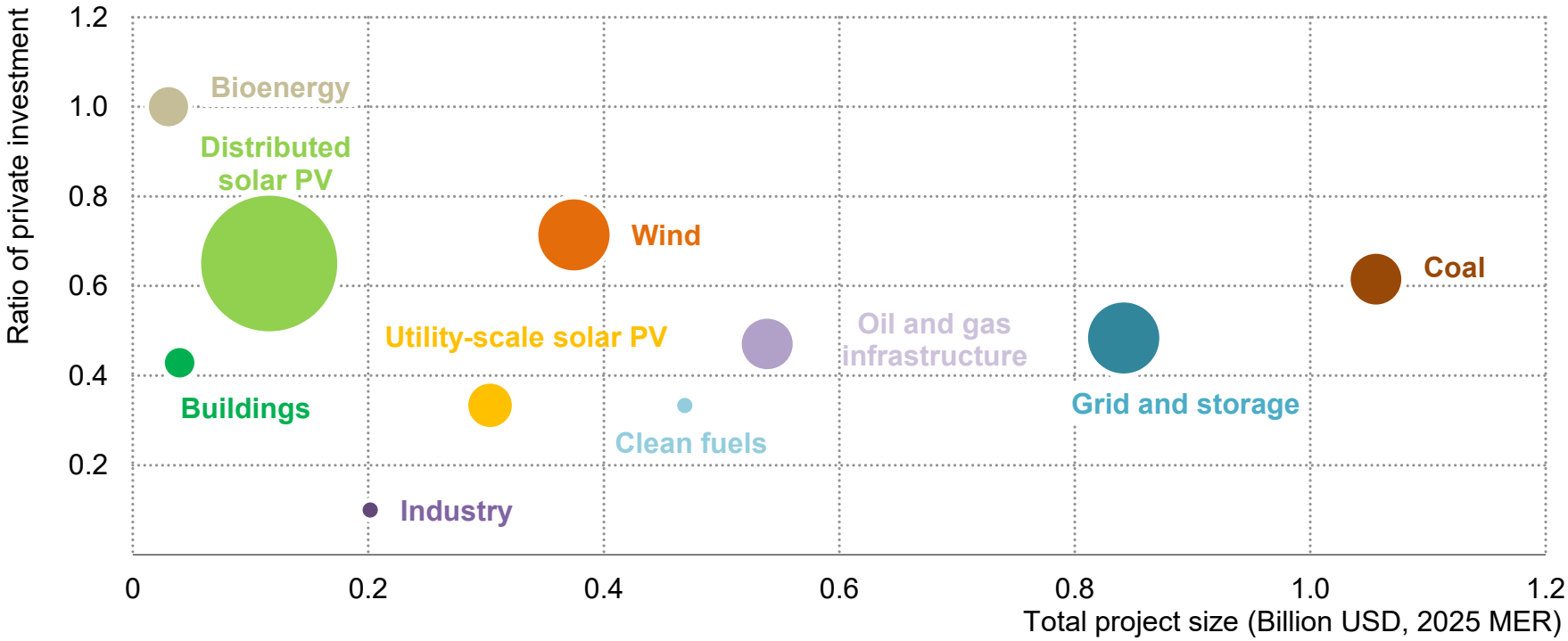
This reorientation coincides with an important inflection point. Total energy investment in China is set to reach around USD 945 billion in 2026, a 5% increase since 2025. However, investment in low-emissions power decreases from roughly USD 315 billion in 2025 to less than USD 290 billion in 2026. This moderation reflects a slowing of wind and solar deployment after years of exceptional expansion and front-loaded project completions ahead of the reduction in subsidies and the shift to market-based pricing mechanisms for renewables.

Along with mature technologies, China is placing greater emphasis on emerging technologies seen as critical for long-term energy security and competitiveness. Notably, investment in advanced nuclear continues to expand, making it one of the few generation segments for which spending continues to increase. China is also stepping up its ambitions in next-generation fields such as fusion, illustrated by the establishment of a state-owned fusion company in 2025 with initial capital of around CNY 11.5 billion (USD 1.6 billion). Hydrogen and low-carbon fuels are similarly gaining prominence in China's long-term planning, as highlighted by a new national integrated-application pilot launched in 2026 – worth up to CNY 1.6 billion (USD 226 million) per city cluster – demonstrating substantial state support for technologies yet to be developed at scale.

Together, developments in 2026 point to a rebalancing of China's investment portfolio rather than a cyclical downturn towards strategic technologies, setting the tone for the 15th Five-Year Plan and beyond.

Private capital plays a distinct complementary role in China's energy investment

Private sector participation in energy projects in China, 2025



Private capital is most active in distributed solar PV and smaller-scale wind projects, which have shorter development cycles and commercially exposed revenues. While larger system assets dominate total investment, they are less accessible to private investors.

Notes: MER = market exchange rate. Projects represented in this figure were recommended and approved by the Chinese government for private sector participation in 2025. "Total project size" refers to the total investment value of the projects for each technology, including public investment and private capital, if applicable. Bubble size is proportionate to the number of projects approved.

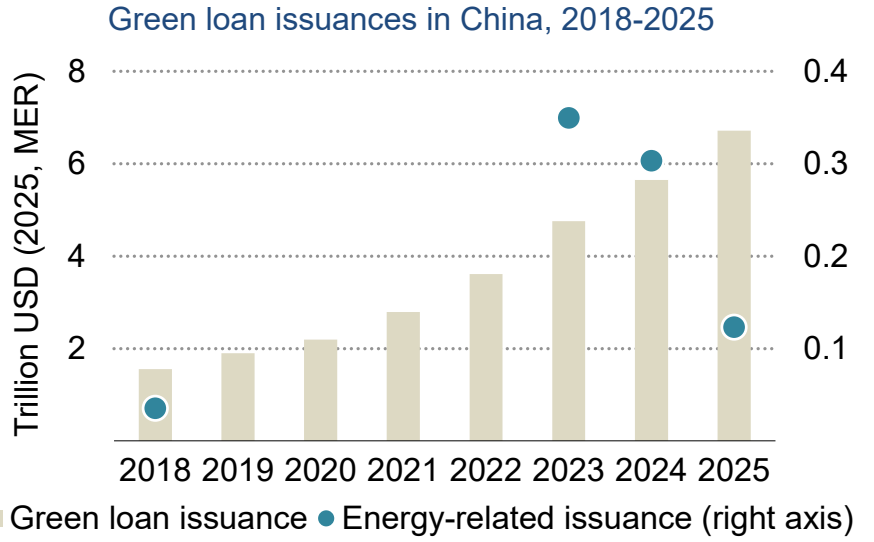
Source: IEA analysis based on data from Government of China (2026), National Online Approval and Supervision Platform for Investment.

Grid expansion and green finance underpin China's 2026 energy transition

China's shift towards a more integrated, flexible and technology-rich energy system places new emphasis on the foundations that enable this transition to unfold at scale. In 2026, investment focus is increasingly moving beyond generation capacity towards networks, flexibility resources and financing mechanisms to support electrification and the rise of advanced energy technologies. Grid expansion, system-level innovation pilots and rapidly growing green finance are all essential to sustain momentum as the composition of investment evolves.

Grid investment continues to rise, roughly to USD 140 billion in 2026. While grid expansion is crucial to integrate the large volumes of wind and solar added in recent years, it is increasingly being framed as a priority investment to support system resilience and energy security, with an emphasis on accelerating key projects under challenging external conditions. The State Grid Corporation of China has announced plans to invest around CNY 4 trillion (USD 566 billion) during 2026-2030, a significant increase from the previous five-year period, with spending focused on ultra-high-voltage transmission as well as distribution network upgrades to accommodate distributed solar installations, electrification and electric vehicles.

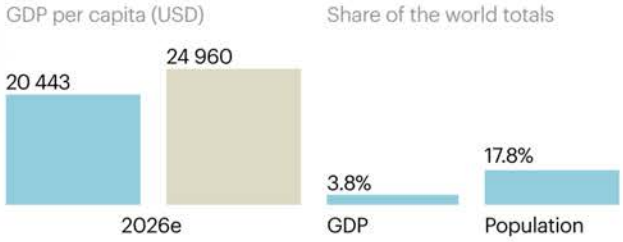
Green finance continues to expand as a major enabler of China's energy transition. Green loan stocks reached CNY 44.8 trillion (USD 6.3 trillion) in 2025, with strong growth in lending to clean energy, grids and low-carbon infrastructure. Green bond issuance is also accelerating, exceeding CNY 1 trillion (USD 142 billion) in 2025, with nearly half directed to green and low-carbon energy transition industries and a further one-third to green infrastructure upgrading. This deepening pool of capital makes conditions more favourable for investment in system-level integration and emerging technologies.



Notes: MER = market exchange rate. "Energy-related issuance" reflects clean energy (power) lending up to 2024 and low-carbon transition lending in 2025. **Methodology changes limit comparability across years**.
Source: IEA analysis based on data from the People's Bank of China (2025), Statistical Report on Loan Investment of Financial Institutions in the Fourth Quarter of 2025.

India

Economic and financial indicators



Sovereign debt rating
BBB

Currency value against USD (2016-26)
+56.9 %

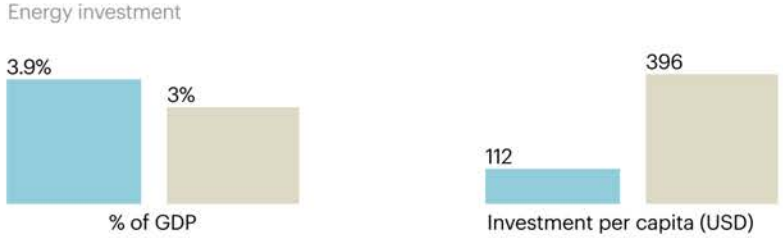
Country risk premium
2.85 %

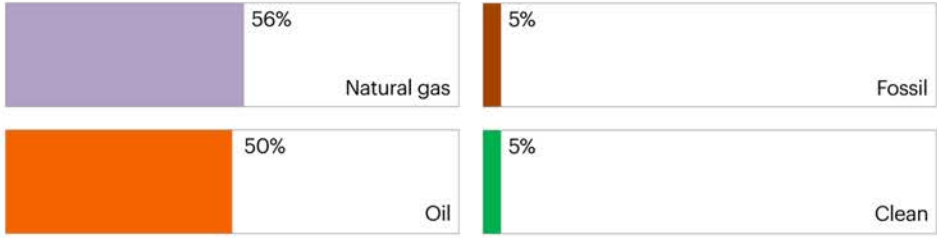
Debt to GDP ratio
81.29 %

Change in 10-yr gov bond yield since 2020
-26 bps

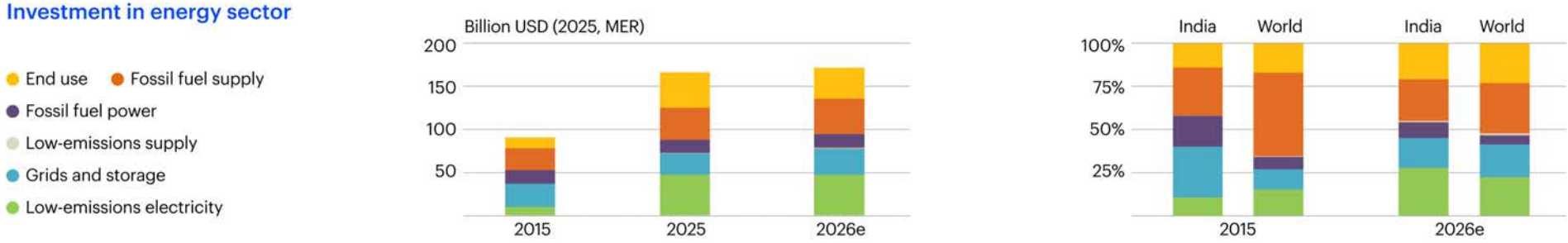
Change in 10-yr gov bond yield since Mar 2026
+35.8 bps

Energy investment indicators





Investment in energy sector



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Investment surges in solar PV and oil refining propel India's energy investment to new heights

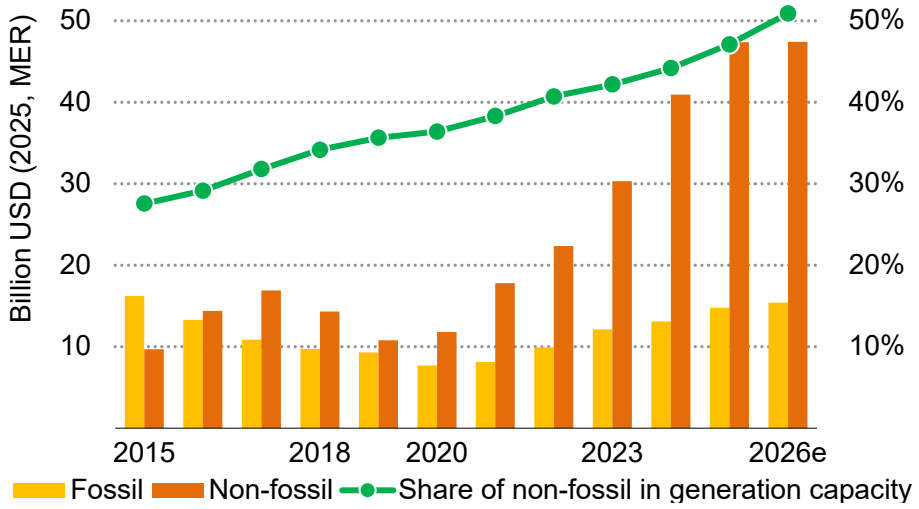
Energy investment in India has grown 11% annually on average in the past five years and is set to reach USD 170 billion in 2026. Investment in solar PV grew annually by 25% in this period, and oil refining by 23%. Together, these two sectors contributed to one-fourth of India's energy investment growth.

This rise in oil refining investments has put India on track for a nearly 15% increase in refining capacity by 2030. While the country is a net exporter of refined products, it imports a vast majority of its crude oil needs. Since upstream oil spending has shrunk by an average of 7% annually since 2020, the government recently introduced a new licensing system to attract investment.

Coal remains the bedrock of India's power generation and industrial energy needs. Demand is met largely by domestic mining. Investment in coal supply has been growing steadily and is set to reach USD 13 billion in 2026 to attain the government target of 1.5 billion tonnes of production by 2030, up from 1 billion tonnes today.

Power sector investment accounts for around half of India's total energy sector spending. In 2025, the country marked a significant milestone with achievement of its Nationally Determined Contribution (NDC) goal of 50% power generation capacity from non-fossil sources. It reached this target five years early owing to an upswing in solar PV investment (USD 20 billion in 2025). Conversely, coal-fired power generation investments have fallen to 40% of the 2010 peak. Today, for every dollar invested in fossil-based generation, India invests three in renewables and nuclear, up from 1.5 just five years ago.

Power generation investment and shares of non-fossil in generation capacity, 2015-2026e

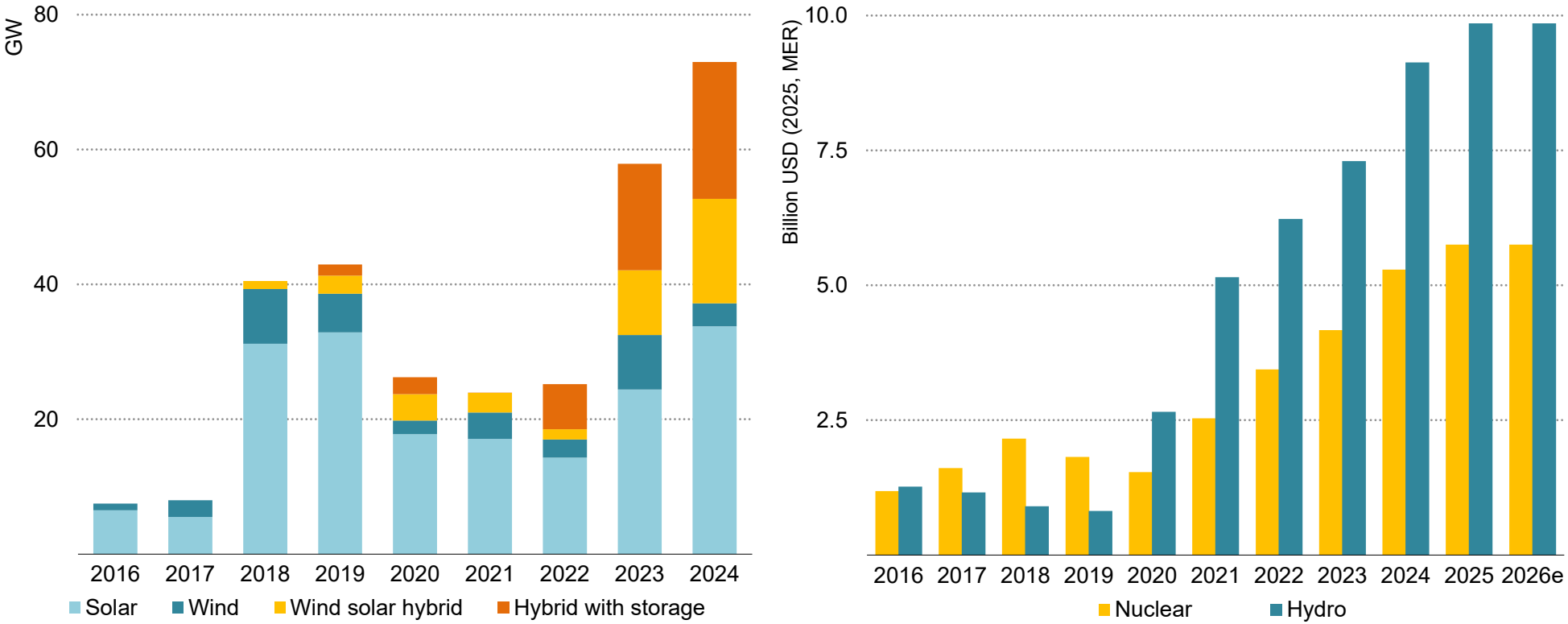


Notes: MER = market exchange rate. 2026e = estimated.

End-use energy investment is dominated by spending on efficiency, which has grown more than 10% annually in the past five years to USD 18 billion. However, even though EV purchases are surging, they started from a low base and therefore remain low at USD 2 billion, accounting for 5% of total vehicle sales.

To manage solar and wind generation variability, India has expanded hybrid and storage project tenders and doubled investment in dispatchable non-fossil generation

Renewable energy tenders issued (left) and nuclear and hydro power generation (right)



India’s investment spending on nuclear and hydropower both tripled between 2021 and 2025.

Notes: MER = market exchange rate. Hybrid with storage capacity refers to projects with solar and/or wind with storage. does not include standalone storage.
Source: Renewable energy tenders issued by JMK Research & Analytics and IEEFA (2025), India Issues Record 73 Gigawatts of Utility-Scale Renewable Energy Tenders in 2024.

India is investing heavily in grid upgrades, energy storage and dispatchable power to support the surge in variable renewable capacity

Sharp rises in solar PV and wind investments have taken their share to over 50% of installed capacity in India. The increase in variable renewable electricity from these two sources has necessitated power sector infrastructure upgrades to avoid curtailment. These include grid upgrades to evacuate electricity from renewable sources; energy storage capacity additions; and the development of dispatchable electricity generation in line with India's ambition of installing 500 GW of non-fossil-fuel capacity by 2030.

Between 2020 and 2025, investments in hydropower and nuclear energy – both non-fossil dispatchable sources – have tripled, as new projects are being built. India aims to install 100 GW of nuclear capacity by 2047, up from 9 GW today. To further promote investment, the government introduced a new reform in 2025 to end the state monopoly of nuclear power, allowing private companies with up to 49% foreign equity to build and operate reactors and SMRs.

For energy storage, India has been promoting capacity additions through both pure energy storage systems (ESS) and wind-solar hybrid (WSH) projects. It has also established a viability-gap funding programme supported by the Power System Development Fund to crowd in investment, providing financial aid to scale up battery storage in the country – as long as it meets the 20% local content requirement.

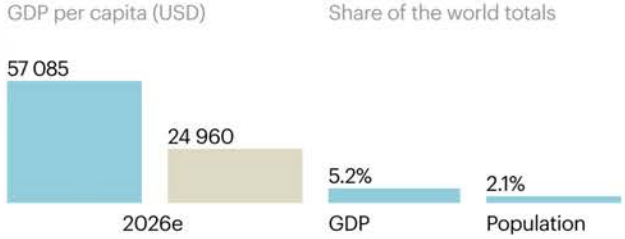
In 2025, ESS project tenders shot up to over 100 GWh, with battery tenders making up 60 GWh. This is more than double the previous year's tenders – and more than ten times the 2023 level. WSH tenders have also surged, accounting for more than half of the 63 GW of capacity awarded in 2024. However, challenges persist despite this success, including undersubscription and cancellations of some tendered capacity.

As battery storage projects scaled up, the discovered tariff of storage fell from USD 14 700/MW/month in 2023 to less than USD 3 000/MW/month in 2025. In addition to battery storage, a new roadmap by the Central Electricity Authority (CEA) targets 100 GW of pumped storage by 2035-36.

Finally, transmission and distribution investment are set to reach USD 26 billion in 2026 after growing 15% annually for the previous five years. Supportive policies have been introduced to promote grid investment. For instance, the Green Energy Corridor project was conceived to inject large volumes of solar and wind power into national and state grids. The first phase is complete, with over 3 000 km of new lines funded through 30% equity and 70% debt from multilateral development banks and commercial loans. Work on subsequent phases of this project is now under way.

Japan and Korea

Economic and financial indicators



Sovereign debt rating

Japan: A+ Korea: AA

Debt to GDP ratio

Japan: 236.66 % Korea: 52.49 %

Currency value against USD (2016-26)

Japan: -23 % Korea: -21 %

Change in 10-yr gov bond yield since 2020

Japan: +218 bps Korea: +189 bps

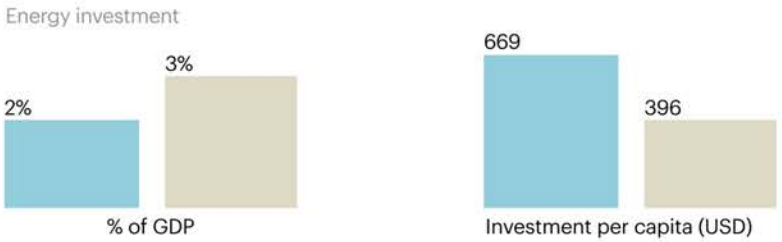
Country risk premium

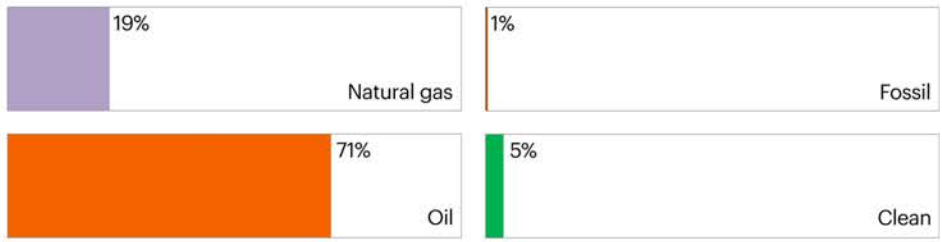
Japan: 0.91 % Korea: 0.64 %

Change in 10-yr gov bond yield since Mar 2026

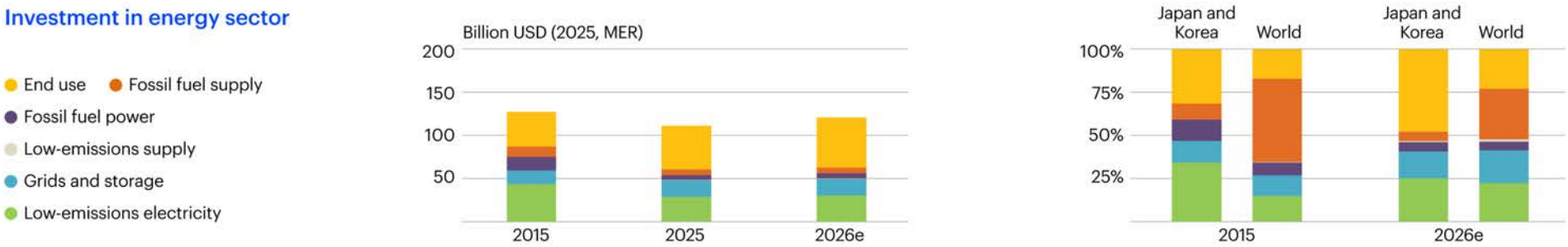
Japan: +41 bps Korea: +48 bps

Energy investment indicators





Investment in energy sector

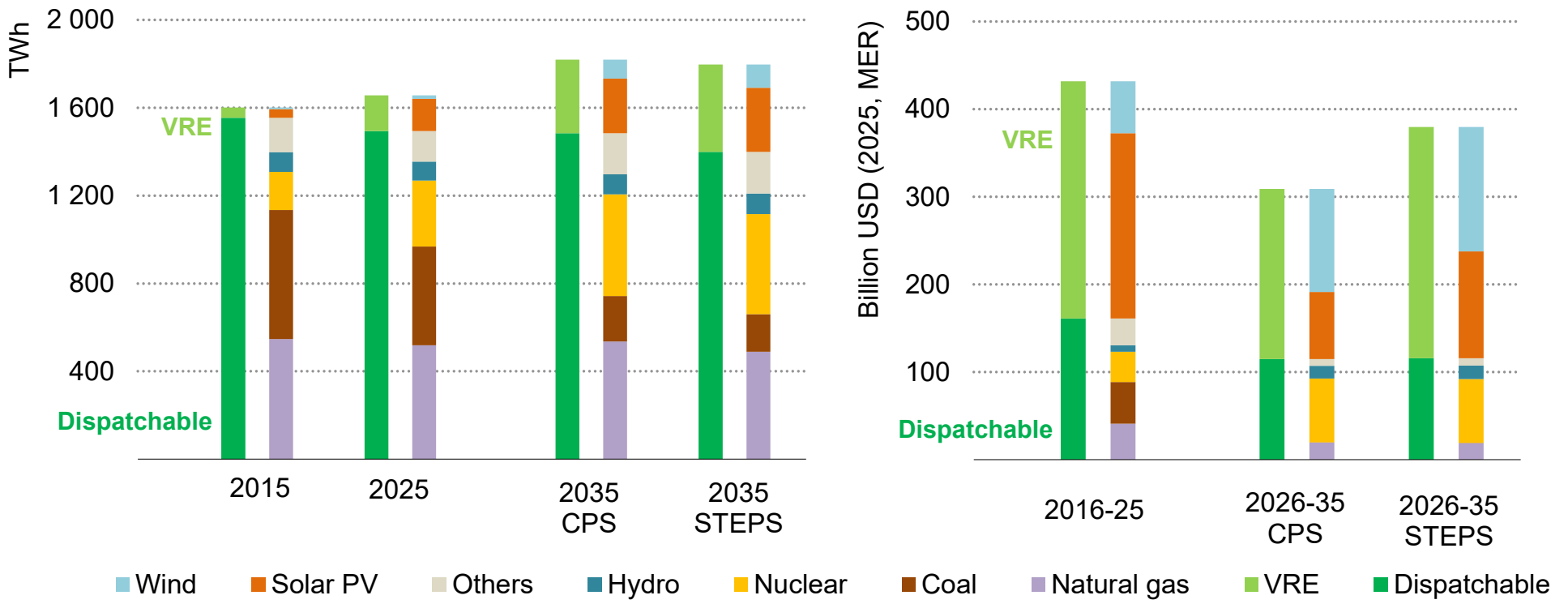


Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

As the share of variable renewables expands in Japan and Korea, investment in dispatchable generation is critical to ensure electricity security

Electricity generation by source (left) and electricity-related cumulative investment (right), 2015-2035

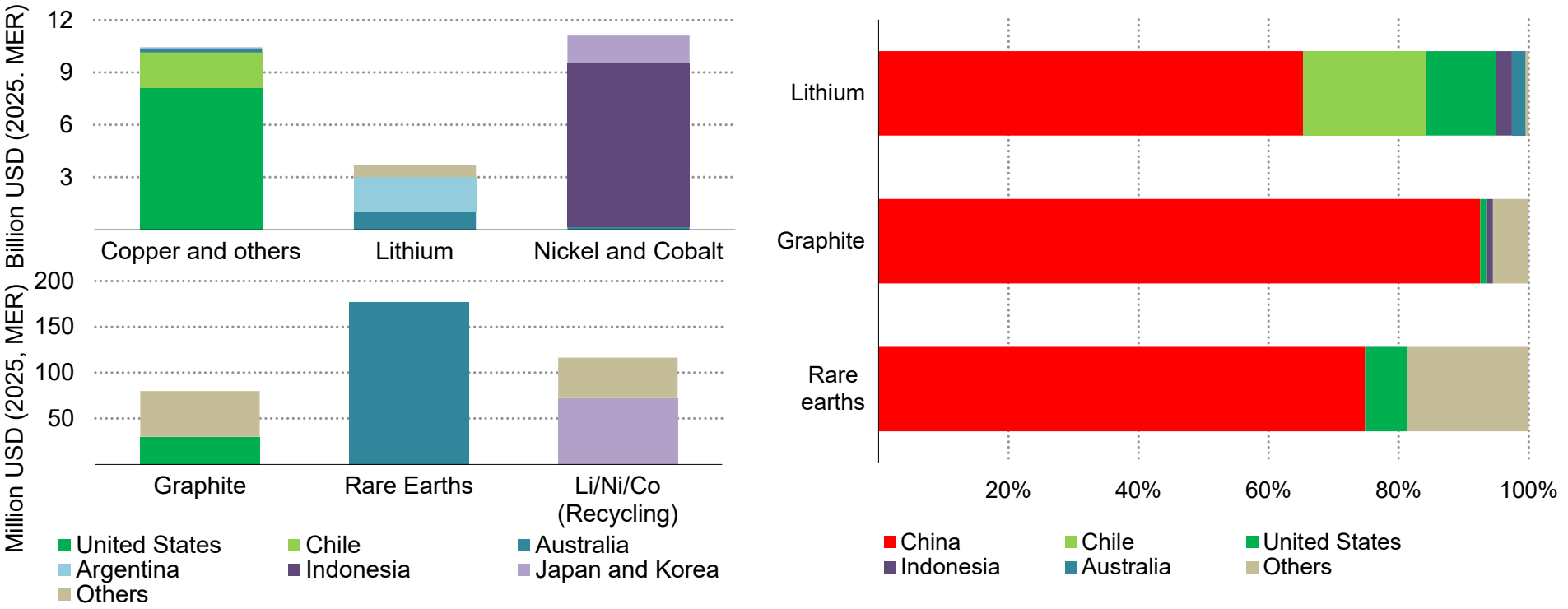


Although capital flows for dispatchable power are set to contract from the current level across all scenarios, it is crucial to secure adequate investment and financing to maintain generation capacity with a robust safety margin.

Notes: MER = market exchange rate. CPS = Current Policies Scenario. STEPS = Stated Policies Scenario. VRE = variable renewable energy (solar PV and wind). "Dispatchable" refers to nuclear, hydro, natural gas, coal and other generation sources.

Expanding critical mineral investments remains important for Japan and Korea to mitigate the risks of highly concentrated supply chains

Investment in critical-mineral value chains, 2020-2025 (left) and import shares by country on an import-value basis, 2025 (right)



Investments in critical minerals have been directed towards Pacific Rim countries. Developing resilient supply chains that bypass traditional chokepoints and mitigate single-country concentration is strategically important to bolster energy and economic resilience.

Notes: MER = market exchange rate. The left graph represents mining, refining and recycling investments announced by major companies. The right graph illustrates IEA analysis of trade statistics for lithium hydroxide, flake graphite and rare earth compounds in Japan and Korea.

Japan and Korea are boosting investment in a multi-faceted energy security approach while continuing to advance their energy transitions

High import dependency, energy-intensive industrial bases and geopolitical exposure characterise Japan and Korea, as highlighted by the ongoing energy crisis. Both countries are at a critical energy security juncture at which they must look beyond fossil fuel security to protect their electricity supplies and critical mineral supply chains.

Power sector investment is becoming a central pillar of energy security and transition efforts in Japan and Korea. Rapid data centre expansion and broader electrification have increased electricity demand, underscoring the need to shift from maintaining to expanding power supply capacities. Aggregated electricity supply is set to increase by around 9%, to approximately 1 800 TWh in 2035.

Under the CPS and STEPS, strong policy support, including Korea's commitment to deploy 100 GW of renewable capacity by 2030, is driving variable renewable energy (VRE) development, led by solar PV and wind. However, this VRE expansion underscores the importance of dispatchable power to maintain electricity system adequacy and security.

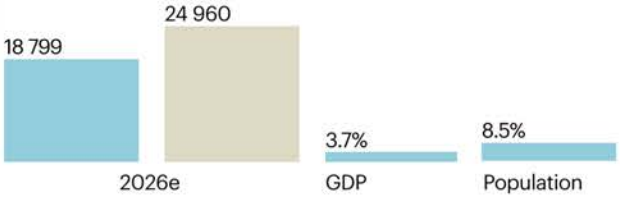
Nuclear power is re-emerging as a clean and secure source of baseload generation. To bring its operational fleet to 15 units in early 2026, Japan recently accelerated reactor restarts, including reinitiating operations at the world's largest nuclear facility, Kashiwazaki-Kariwa. Meanwhile, Korea is including new large-scale reactors and SMRs in its 11th Basic Plan for Long-Term Electricity Supply and Demand. These developments reflect a shift to maximise the use of existing assets and mobilise capital for new capacity. Indeed, investments of around USD 120 billion in dispatchable power are projected for the upcoming decade. Supportive regulatory and market frameworks to secure projected cash flows will be indispensable to maintain adequate generation capacity.

Japan's and Korea's critical mineral investments are increasingly being directed across the Pacific Rim area, with capital flows notably targeting the United States, South America, Australia and the broader Asia region. Given that both countries are exposed to import concentration risks from China, investing to bypass traditional chokepoints remains essential to secure supply chains.

In 2025, Korea Zinc and the US government announced a USD 6.6 billion project to construct a large-scale smelter for copper and various other minerals in the United States, showcasing how policy support for energy security can mobilise capital. Both countries are seeking minority shares in mining projects to secure offtake, whereas in refining, majority stakes are often acquired to operate assets. Given their limited resources, recycling is important to secure domestic feedstocks and reduce upstream supply risks.

Southeast Asia

Economic and financial indicators



Sovereign debt rating
BB+ to AAA

Currency value against USD (2016-26)
10 to -20 %

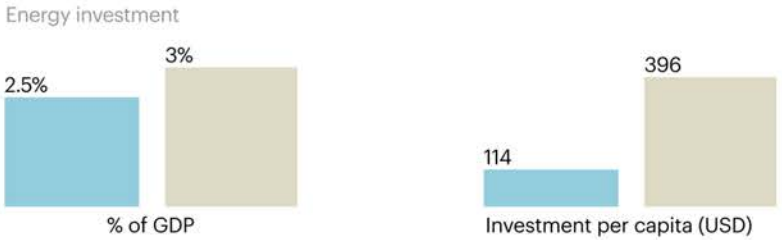
Country risk premium
0 to 11.66 %

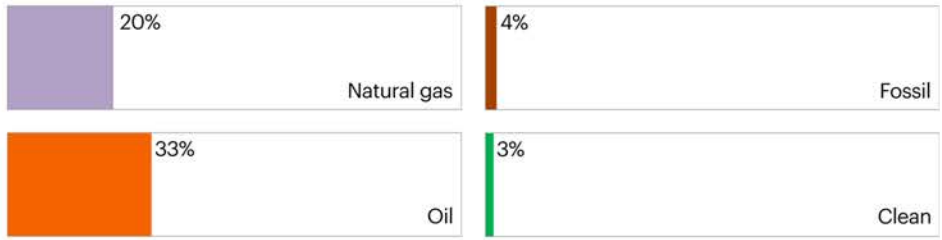
Debt to GDP ratio
177 to 2.29 %

Change in 10-yr gov bond yield since 2020
-24 to +36 bps

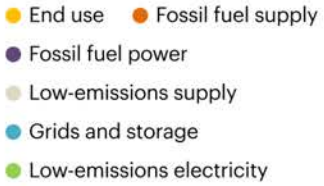
Change in 10-yr gov bond yield since Mar 2026
+7 to +41 bps

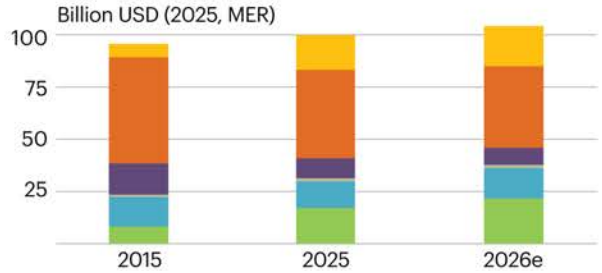
Energy investment indicators

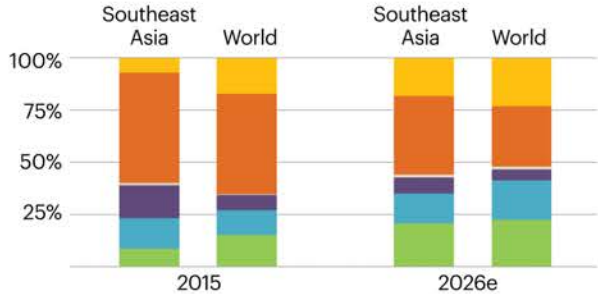




Investment in energy sector







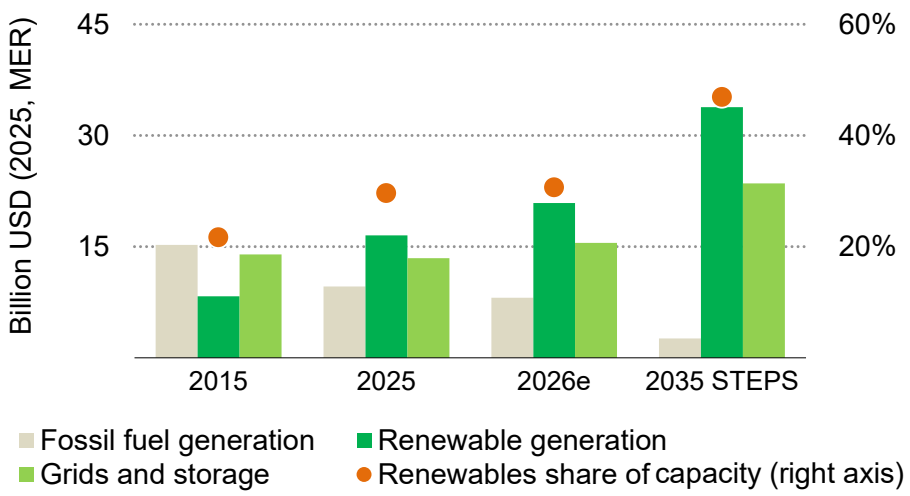
Notes: bps = basis points. 2026e = estimated. “Change in 10-year government bond yield” compares January 2020, February 2026 and April 2026 bond yields for Indonesia and Singapore. Share of imports from the Middle East is calculated as total import of crude oil, condensates and oil products from Middle East over the total import of crude oil, condensates and oil products based on available data.

Sources: IEA analysis based on data from S&P (2025), Sovereign Ratings List; S&P (2026) database; Bloomberg (2026) database; IMF (2026), Global Debt Database; and Damodaran, A. (2026), Country Default Spreads and Risk Premiums database. All databases were accessed on 29 April 2026.

Southeast Asia investments in renewable generation and grids are expected to reach new highs in 2026 as the region sets ambitious 2030 targets

Amid continued high growth in electricity demand, renewables investment in Southeast Asia is expected to reach USD 22 billion in 2026, surpassing the heights of 2025 and 2019 (which had been driven by rapid solar deployment in Viet Nam), while spending on conventional sources of generation falls back slightly. Today's renewable investments are more evenly distributed across solar, hydro, wind and geothermal technologies, and could receive additional impetus as a result of today's conflict in the Middle East. Policy announcements and procurement trends indicate continued investment growth. The October 2025 ASEAN Plan of Action for Energy Cooperation 2026-30 targets a 45% share of renewable energy in installed power capacity by 2030, compared with 32% today. In the Philippines, recent auctions awarded 10.2 GW of solar, wind and storage, with a 3.3-GW auction for offshore wind under way. Corporate power purchase schemes are providing new avenues for renewable energy contracts in Malaysia and Viet Nam, and a 2-GW pilot direct power purchase agreement programme for data centres is expected in Thailand in 2026. Indonesia has announced ambitions to deploy 100 GW of solar, including 80 GW of distributed solar plus 320 GWh of BESS across 80 000 villages. Grid investments are expected to reach USD 15 billion in 2026, accelerating after several years of underinvestment (spending on grids was lower in 2025 than in 2015). Power development plans are increasingly prioritising grid investments to meet demand growth and improve system resilience. With similar drivers, momentum is growing for cross-border power trade through the ASEAN Power Grid (APG), with USD 27 billion needed for cross-border interconnections by 2040. However, supply chain pressures continue to constrain delivery, with lead times for cables and large power transformers doubling since 2021.

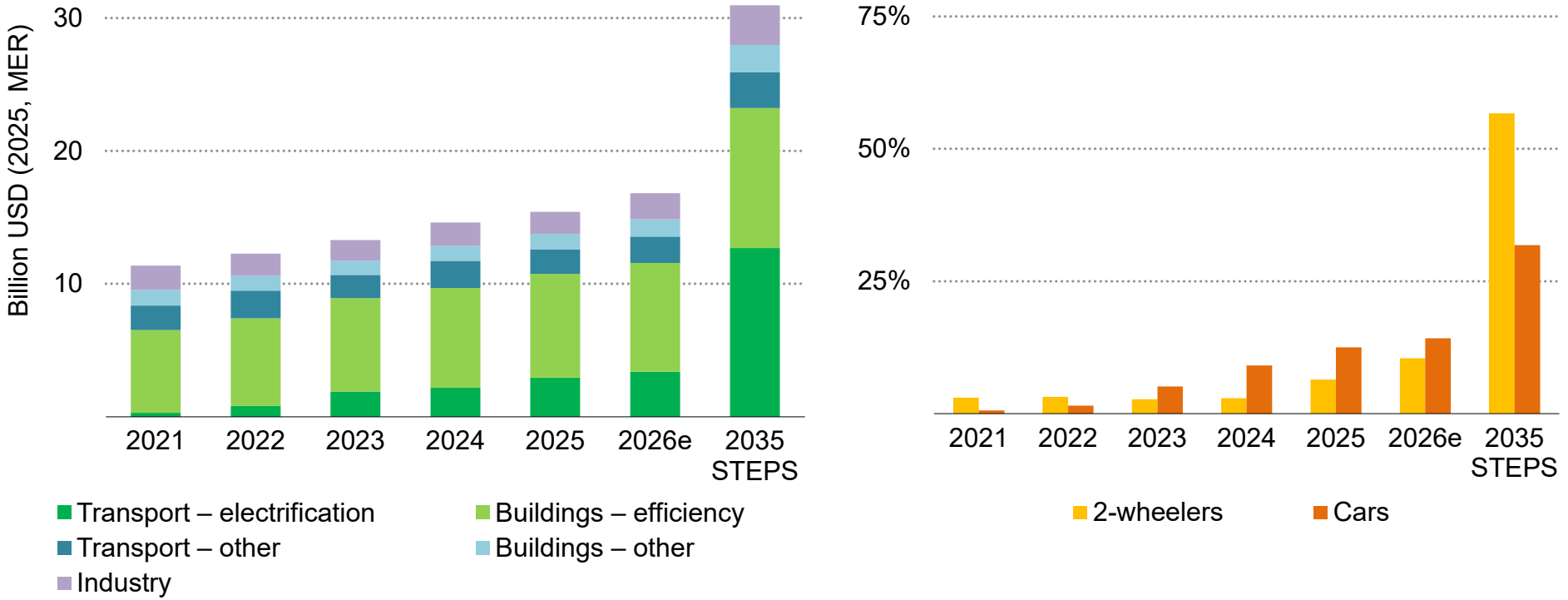
Power sector investments and renewable generation capacity shares in Southeast Asia, 2015-2035



Notes: MER = market exchange rate. 2026e = estimated. STEPS = Stated Policies Scenario.

Electric vehicles and air conditioning have driven investment in end-use sectors up 70% since 2021

Investment in end-use sectors (left) and penetration of electric vehicles in vehicle sales (right) in Southeast Asia, 2021-2035



An eightfold increase in transport electrification spending accounts for most of the 2022-2026 growth in end-use investment. With rapid electrification of 2-wheelers, electric vehicles are expected to make up half of total vehicle sales by 2035.

Notes: MER = market exchange rate. 2026e = estimated. STEPS = Stated Policies Scenario.

Global supply chain diversification creates opportunities for Southeast Asia to establish resilient energy technology value chains – from minerals to manufacturing

Amid global efforts to diversify supply chains and reduce concentration risks, Southeast Asia is positioning itself as an attractive location for energy technology value chains. At the same time, tight supply chains – including for gas turbines and transmission equipment – are constraining deployment within the region, highlighting the opportunity to develop regional capacity. Growing technology demand, both within and outside the ASEAN region, can underpin investment in regional manufacturing. For instance, in March 2026, GE Vernova announced a USD 200-million investment in Viet Nam to manufacture large power transformers, supported by growing regional and global demand for high-voltage direct current (HVDC) transmission infrastructure. Meanwhile, CATL, Indonesia Battery Corporation and PT ANTAM broke ground on a USD 6-billion battery manufacturing facility in Indonesia in October 2025, signing supply agreements with two projects for a total of up to 2.2 GWh and up to 4 GWh of BESS, to export power from Indonesia to Singapore. Finally, Indonesia's Electricity Supply Business Plan (RUPTL) for 2025-2034 includes plans to deploy standalone BESS capacity of 6 GW .

However, progress remains uneven. Cambodia's solar manufacturing sector, in which exports grew to USD 2.4 billion in 2023 before falling to USD 4.4 million in the first half of 2025 following the imposition of US duties, highlights investment risks when demand is external and exposed to the effects of policy action.

Mineral endowments are increasingly being used as a lever to attract downstream manufacturing as countries seek to expand their presence across value chains. Through its sustained industrial policy, Indonesia has attracted USD 32 billion of investment in nickel processing since 2020. Malaysia, home to the world's largest rare-earth processing plant outside of China, announced it will build a USD 143 million super magnet facility in partnership with JS Link and Lynas. In Viet Nam, Lynas and LS Eco Energy announced plans to develop a rare-earth processing facility following restrictions on rare earth ore exports. Nevertheless, connecting upstream production with downstream manufacturing remains challenging. While the region's mineral resources provide a foundation, its industrial competitiveness depends on enabling conditions such as a skilled workforce, reliable and affordable energy, a well-developed innovation ecosystem and reasonable labour and capital costs.

Through clear policy support, strategic international partnerships and continued infrastructure investments, Southeast Asia has an opportunity to establish resilient and integrated energy technology value chains, particularly if mineral endowments can be effectively linked to downstream manufacturing and regional demand.

Methodology

Tracking energy investment

The way investment is measured across the energy spectrum varies, largely because of differences in the availability of data and the nature of expenditures. This document highlights the methodology used to ensure that the estimates are consistent and comparable across sectors in the World Energy Investment 2026 (WEI 2026) report and other publications from the International Energy Agency.

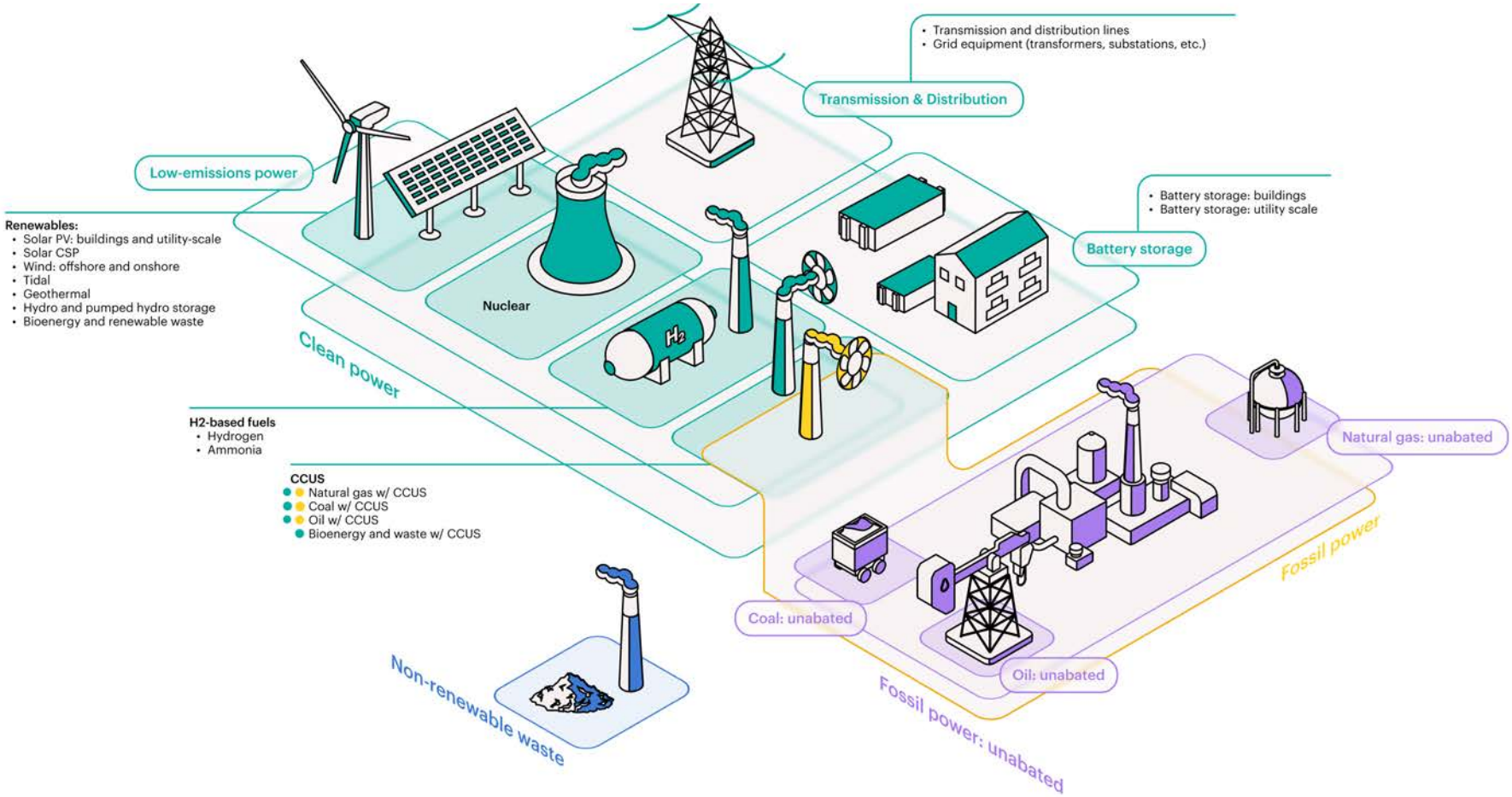
The IEA measures investment as the ongoing capital spending on assets. For some sectors, such as power generation, this investment is spread out evenly from the year in which a new plant or upgrade of an existing one takes a final investment decision (FID), i.e. when a project reaches financial close or begins construction) to the year in which it becomes operational. For other sources, such as upstream oil and gas and liquefied natural gas (LNG) projects, investment reflects the capital spending incurred over time as production from a new source ramp up, or to maintain output from an existing asset.

For energy efficiency, the measurement task is more complex and much of the expenditure is by consumers for whom purchases of more efficient goods are not investments per se. In WEI 2025, as in other recent IEA reports, investment in energy efficiency aims to reflect the incremental spending by companies, governments, or individuals to acquire a piece of equipment that is more efficient than the local market average. Due to the different possible methodologies available, this estimate of energy efficiency investment is not definitive but still included to provide a comparison with the scale of investment in energy supply. Fossil fuel and power sector investments are those that raise or replace energy supply, while energy efficiency are counted as those that reduce energy demand.

Investment estimates are derived from International Energy Agency (IEA) data for energy demand, supply and trade, and estimates of unit capacity costs, analysis of which benefits from extensive interaction with industry. By default, investment data are given in year 2025 US dollars, adjusted using country-level gross domestic product (GDP) deflators and 2025 exchange rates. Unless otherwise stated, all time series and historical comparisons are presented in real 2025 US dollar terms, adjusted for inflation.

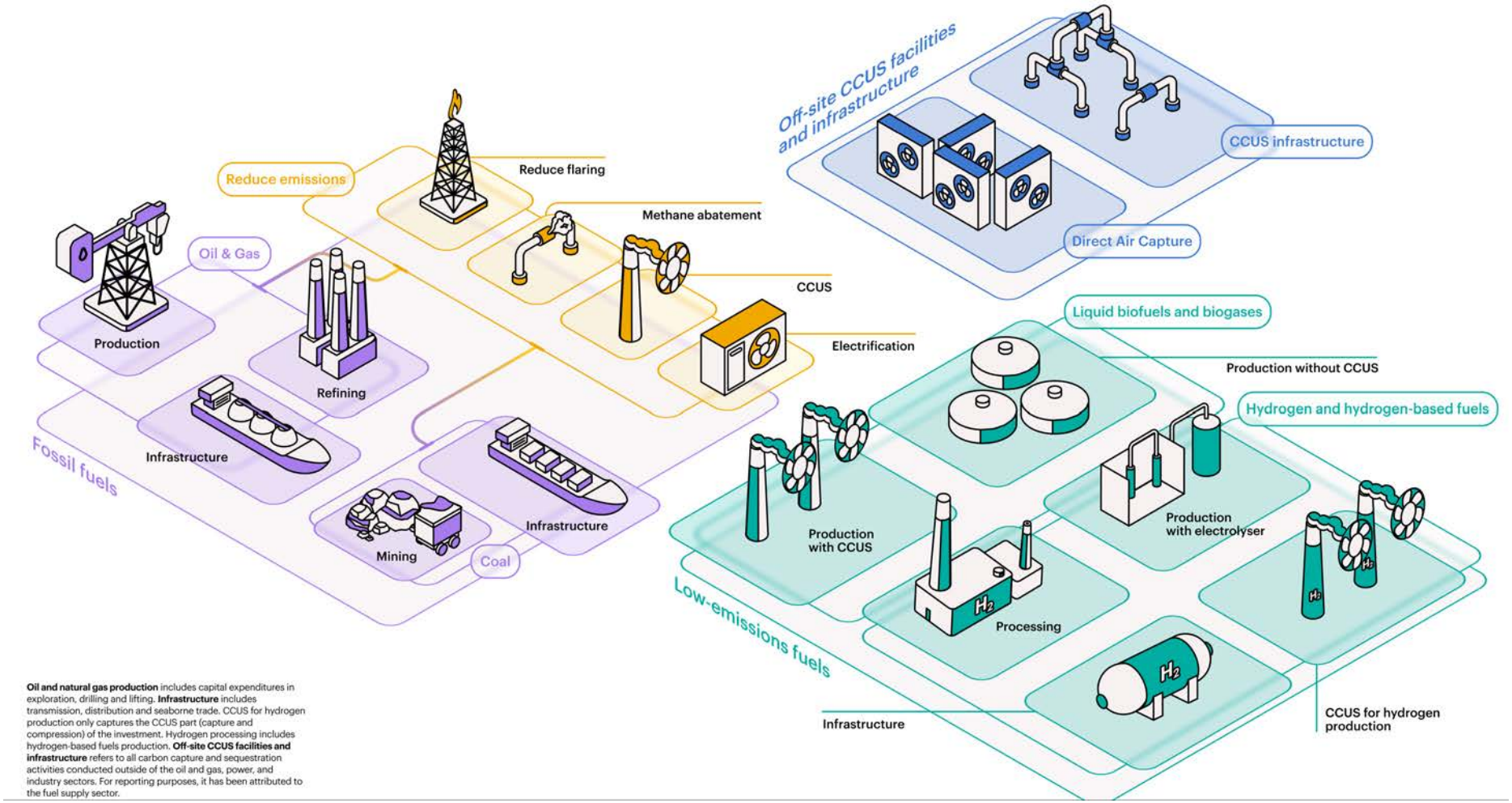
This investment approach mirrors real-world practices and aligns with capital expenditure in financial reporting. In reality, time lags and varied spending occur between FID and project operation. Where possible, financial and energy performance metrics are included to better reflect asset turnover and capital commitment decisions. Other areas of spending – including operating and maintenance expenditures, R&D, financing costs, mergers and acquisitions or public markets transactions – remain important for energy sector development, and are analysed on a standalone basis in IEA investment work, but are not included in the calculations of WEI 2026.

Investment in power



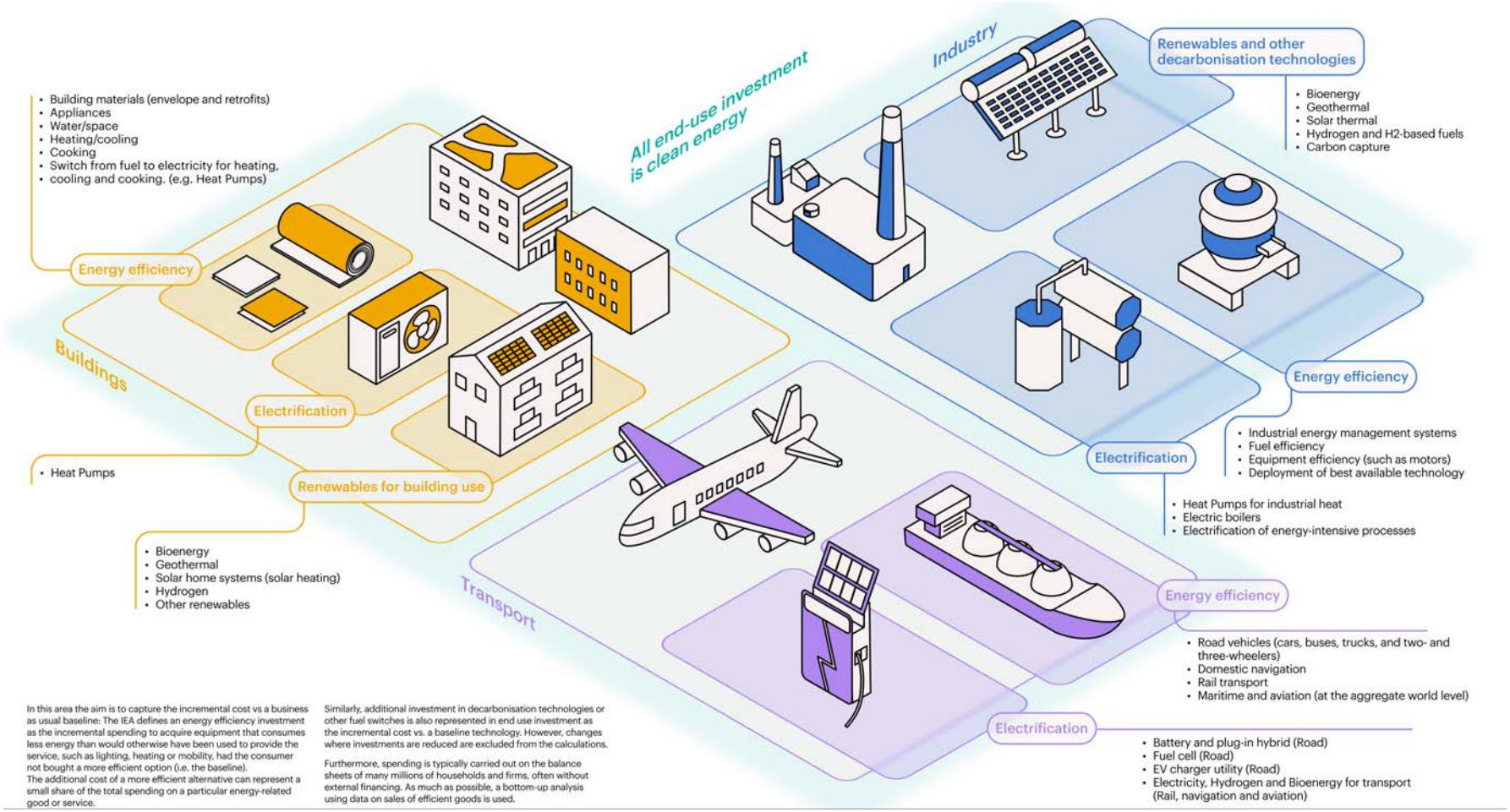
The estimates of electricity investment presented in WEI 2026 correspond to annual capital spending on new power plants, battery storage and grid assets, or the replacement of old assets

Investment in fuel supply



Investment estimates for oil, gas and coal are based on capital spending announcements by some 90 oil and gas majors, independents and national companies, Investment in LNG is based on spending for projects that reached FID between 2000 and 2026.

Investment in energy demand and electrification



Investment in energy efficiency incremental spending to acquire equipment that consumes less energy than would otherwise have been used to provide the service, such as lighting, heating or mobility, had the consumer not bought a more efficient option

Methodology used for the regional section

Sovereign debt rating: The long-term foreign currency rating assessed by S&P Global Ratings as of 11 December 2025. Sovereign debt rating as assessed by S&P ranges from D (default) to AAA.

- **Africa**: 24 of the 54 countries have an S&P rating.
- Latin America: 29 of the 44 countries have an S&P rating.

Change in 10-yr govt bond yield since 2020: Government bond yield data are taken from the Bloomberg Terminal, except for data on Zambia, which are taken from Trading Economics. This indicator compares the 10-yr government bond yield in basis points (bps) between January 2020 and the latest available data. Government bond yield data for regions are as follows:

- **Africa**: data from South Africa and Zambia.
- **Latin America**: data from Peru and Brazil.
- **Middle East**: no data available.
- **Eurasia**: data from Russia.
- **Southeast Asia**: data from Indonesia and Singapore.

Country risk premium: Country risk premium data is taken from the Country Default Spreads and Risk Premiums database by Professor Aswath Damodaran of NYU. Availability of risk premium data from the database is as follows:

- **Africa**: 41 out of 54 countries are represented.
- **Latin America**: 28 out of 44 countries are represented.
- **Middle East**: Missing data from Iran, Syria and Yemen.
- **Eurasia**: Missing data from Russia and Turkmenistan.

Currency value against the USD: Exchange rate data are taken from S&P Capital IQ. The rate of depreciation against the USD is calculated in the period between January 2015 and January 2026.

- **Latin America:** Excludes Venezuela.
- **Middle East:** Excludes Lebanon and Syria.
- **European Union**: The currency value of the euro is used.

Debt to GDP ratio: IMF data from 2024 are taken. General government debt is used where available, and where not available, central government debt is used. Here is a list of countries where debt sustainability data are not available:

- **Africa**: No data from Cape Verde, Eritrea, Libya and Somalia.
- **Latin America**: No data from Anguilla, Aruba, Bahamas, Bermuda, Bonaire, Sint Eustatius and Saba, British Virgin Islands, Cayman Islands, Cuba, Curacao, Ecuador, Falkland Islands, Montserrat, Saint Pierre, Sint Maarten, Turks and Caicos.
- **Middle East**: No data from Lebanon and Syria.
- **Eurasia**: No data from Georgia.

Categories under the sources of finance model:

- **Commercial finance** includes equity investments made by private enterprises and households, alongside debt from financial institutions, including some finance from state-owned banks.
- **Domestic public finance** includes public equity stakes in private corporations and state-owned enterprises, subsidies, tax incentives and finance from central banks.
- **International public finance** as defined in this report covers development finance institutions, multilateral climate funds, government donors and philanthropies, and export credit agencies.

Country groupings[1]:

Advanced economies: Australia, Austria, Belgium, Bulgaria, Canada, Chile, Colombia, Costa Rica, Croatia, Cyprus[2], Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel[3], Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Puerto Rico, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, United Kingdom, United States.The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Emerging Market and Developing Economies: Afghanistan, Albania, Algeria, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bermuda, Bhutan, Bolivarian Republic of Venezuela, Bonaire, Sint Eustatius and Saba, Bosnia and Herzegovina, Botswana, Brazil, British Virgin Islands, Brunei Darussalam, Burkina Faso, Burundi, Cambodia, Cameroon, Cape

[1] *This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.*

[2] *Note by the Republic of Türkiye: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the "Cyprus issue".*

Note by all the European Union Member States of the OECD and the European Union:
The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

[3] *The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.*

Verde, Cayman Islands, Central African Republic, Chad, Chinese Taipei, Comoros, Cook Islands, Côte d'Ivoire, Cuba, Curaçao, Democratic People's Republic of Korea, Democratic Republic of Congo, Djibouti, Dominica, Dominican Republic, East Timor, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Falkland Islands (Malvinas), Fiji, French Polynesia, Gabon, Gambia, Georgia, Ghana, Gibraltar, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, India, Indonesia, Iraq, Islamic Republic of Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kingdom of Eswatini, Kiribati, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Lesotho, Liberia, Libya, Macau, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mongolia, Montenegro, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Caledonia, Nicaragua, Niger, Nigeria, North Macedonia, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, People's Republic of China, Peru, Philippines, Plurinational State of Bolivia, Qatar, Republic of Congo, Republic of Kosovo, Republic of Moldova, Russia, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Sint Maarten (Dutch part), Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Syrian Arab Republic, Tajikistan, Thailand, Timor - Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkmenistan, Turks and Caicos Islands, Uganda, Ukraine, United Arab Emirates, United Republic of Tanzania, Uruguay, Uzbekistan, Vanuatu, Viet Nam, Yemen, Zambia, Zimbabwe

Latin America and the Caribbean: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivarian Republic of Venezuela, Bonaire, Sint Eustatius and Saba, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands (Malvinas), Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Montserrat, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Sint Maarten (Dutch part), Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden

Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Kingdom of Eswatini, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Republic of Congo, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

Middle East: Bahrain, Iraq, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen

Eurasia: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Uzbekistan

Southeast Asia: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam.

Annexes

Acknowledgements

This report was prepared by the Energy Investment Unit in the Office of the Chief Energy Economist (OCEE) Division of the Directorate of Sustainability, Technology and Outlooks (STO). It was designed and directed by Tim Gould, Chief Energy Economist, Cecilia Tam, Head of the Energy Investment Unit, and Kirsten Smith, who co-ordinated the report.

Courtney Turich led the section on fuel supply; James Bragg led the section on the power sector; Haneul Kim led the section on energy demand and end-use; Luke Hatton (consultant) led the section on R&D and technology innovation; Emma Gordon led the section on energy finance; and Adam Ward led the regional section. Ryszard Pospiech co-ordinated modelling and data across sectors. Eleni Tsoukala provided essential administrative support.

Other main authors of the report were Lorenzo Albertini (regional section), Simon Bennett (R&D), Jacopo Cavagna (demand and finance), Lauren Chan (cross-cutting support, regional section, and data visualisation), Ryan Cheng (cross-cutting support), Pape Mody Cisse (regional section), Musa Erdogan (demand and regional section), Marta Gonzalez Rodrigo (power and regional section), Alex Hegarty (supply), Jeanne-Marie Hays (supply), Zoe Hemez (modelling, power, and regional section), Jerôme Hilaire (supply), Tomoya Iwaki (supply), Gabriele Romeo (supply), Giulio Santi (supply), Siddharth Singh (cross-cutting support, regional section, and data visualisation), Alessia Stedile (finance and regional section), Ryo Yamasaki (finance and regional section), and Peter Zeniewski (supply).

The report benefited greatly from contributions from other experts within the IEA: Carlos Alvarez, Yasmine Arsalane, Heymi Bahar, Ana Alcade Báscones Jose Miguel Bermudez Menendez, Charlene Bisch, Marcus Bockhold, Lia Codrington, Elizabeth Connelly, Tanguy de Bienassis, Michael Drtil, Eric Fabozzi, Mathilde Fajardy, Axel Nordin Furdos, Carl Greenfield, Ian Hamilton (consultant), Andrew Klain, Martin Kueppers, Ruonan Li (consultant), Luca Lo Re, Teo Lombardo, Jules Parfouru, Apostolos Petropoulos, Amalia Pizarro, Richard Simon, Yinglun Teng, Anthony Vautrin, Fabian Voswinkel and Peter Zeniewski.

Valuable input and feedback were provided by senior management and other colleagues within the IEA, in particular Laura Cozzi, Alessandro Blasi, Toril Bosoni, Stephanie Bouckaert, Joel Couse, Jason Elliot, Araceli Pales Fernandez, Paolo Frankl, Timur Guel, Dennis Hesseling, Tae-Yoon Kim, Christophe McGlade, Brian Motherway, Uwe Remme, Maria Sicilia, Brent Wanner, Daniel Wetzel, Blandine Barreau, Eren Cam, Javier Jorquera, Akos Losz, Rita Madeira, David Martin, Chris Matthew, Rebecca McKimm, Jacob Messing, Divya Midha, Gergely Molnar, Roberta Quadrelli, Silvia Saddi, Rebecca Schulz, Thomas Spencer, Talya Vatman, and Ivo Walinga.

Thanks also to Curtis Brainard, Poeli Bojorquez, Astrid Dumond, Jethro Mullen, Liv Gaunt, Andrea Pronzati, Naomi Morduch Toubman, and Wonjik Yang of the Communications and Digital Office. Kristine Douad edited the manuscript.

This report could not have been achieved without the support and co-operation provided by donors to the IEA Clean Energy Transitions Programme (CETP) notably: Australia, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, the United States and the European Commission, on behalf of the European Union as part of its funding of the Clean Energy Transitions in Emerging Economies (CETEE) program within the CETP.

Many experts from outside of the IEA provided input, commented on the underlying analytical work, and reviewed the report. Their comments and suggestions were of great value. They include:

Lucila Arboleya	Laboratorio Tecnológico del Uruguay
Antoni Ballabriga	BBVA
Manuel Baritaud	EIB
Harmeet Bawa	Hitachi Energy
Jorge Blazquez	bp
Nathan Bock	Chevron
Barbara Buchner	Climate Policy Initiative
Younsung Chung	GS Energy
Julian Cubero Calvo	BBVA
Deirdre Cooper	Ninety-One
Kolawole Dairo	African Development Bank
Joseph Pryor	World Bank
Stefano De Clara	ICAP
Charlie Donovan	Dartmouth
Swati Dsouza	Asian Development Bank
Arjun Dutt	CEEW Green Finance Centre
Nikki Fisher	Thungela Resources
Charlotte Gardes-Landolfini	International Monetary Fund
Mark Gilligan	BNP Paribas Asset Management
Pablo González Gascón y Marín	Iberdrola
Maarten Hage	Helios Investment Partners
Adil Hanif	European Bank for Reconstruction and Development
David Hart	Council on Foreign Relations
Lucy Heintz	Actis
Harald Hirschhofer	Energy Materials Corporation
Ronan Hodge	GFANZ
Takashi Hongo	Mitsui & Co. Global Strategic Studies Institute
Christopher Kaminker	BlackRock
Sean Kidney	Climate Bonds Initiative
Issa Kone	African Development Bank

Taihei Koto	JOGMEC
Francisco Laveron	Iberdrola
Evan Li	HSBC
Elchin Mammadov	MSCI
Pedro Martins Barata	Environmental Defense Fund
Divya Midha	Niti Aayog, India
Vincent Minier	Schneider Electric
Peter Morris	Minerals Council of Australia
Kentaro Oe	Ministry of Economy, Trade and Industry, Japan
Padraig Oliver	UNFCCC
Stephanie Pfeiffer	Institutional Investors Group on Climate Change (IIGCC)
David Pugliell	ENEL
Mauricio Riveros Rodriguez	InvestChile
Lamine Robert Koné	African Development Bank
Thomas Roulleau	Agence Française de Développement
Wale Shonibare	African Development Bank
Ravi Singh	Institutional Investors Group on Climate Change (IIGCC)
Gaston Siroit	OLACDE
Reena Suri	India Smart Grid Forum
Kodo Takahashi	Mizuho Financial Group
Makito Takami	Sumitomo Corporation
Atsushi Taketani	JAPEX
Azusa Takeyama	Bank of Japan
Suranjali Tandon	National Institute of Public Finance and Policy
Viola Tang	GIC
Motoshi Tomita	Central Research Institute of Electric Power Industry
Lukas Trakimavičius	NATO
Mika Uchino	Japan Bank for International Cooperation
Laszlo Varro	Shell
Simone Ruiz-Vergote	MSCI
Dr. Khalid Waleed	Sustainable Development Policy Institute
Betsy Winnike	Boston Consulting Group
Kelvin Wong	DBS Bank

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Typeset in France by IEA - May 2026
Cover design: IEA
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