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Quarterly highlight: System level hedging

Michael Lewis
Head of Research ESG

Steffen Kutscher
Head of Stewardship – Standards & Processes

IN A NUTSHELL

- **Summary**: Electrification is emerging as a system-level hedge against fossil fuel volatility which structurally reduces exposure to price and supply shocks. However, this comes at the cost of greater reliance on electricity infrastructure and critical mineral supply chains.
- **The Big Picture**: Geopolitical tensions are accelerating the repricing of the energy transition by emphasizing the importance of energy security. Early signs suggest supply disruptions are already steering consumers towards electrification solutions.
- **Policy**: Structural policies are also being introduced. These aim to reduce fossil energy use and accelerate the pace of electrification. This is true in Europe but also in Asia where over 80% of the region's crude and condensate imports transit through the Strait of Hormuz.[1]
- **Technology & innovation**: Falling costs curves in recent years across solar, batteries and power electronics[2] are helping to drive electrification. Investors should consider how progress varies across the value chain and between mature, inflecting and emerging technologies.

Introduction

In this issue of the Energy & Nature Investor Quarterly we focus on electrification through three lenses – geopolitics, policy and technology. Electrification has gained increasing attention recently highlighted by the "35% by 2035" target set by COP31 President at the Bonn Climate Change Conference in June 2026. This calls for electricity's share of final energy demand to rise from just over 20% today to 35% by 2035. This is now being advanced by the European Commission's Electrify Now coalition,[3] although this has so far not been signed by the U.S., China, Japan and India.

From a geopolitical standpoint, electrification is increasingly viewed as a system-level hedge by reducing exposure to fossil fuel price and supply shocks. This re-pricing is being met by policy action particularly across Asia and Europe, who are the two major economic blocs most exposed to imported fossil fuels: Europe carrying the highest region-wide dependency ratio, and Asia carrying the largest absolute exposure as well as the most acute country exposures in terms of Japan and Korea.[4]

When it comes to technology, the cost curves in areas underpinning electrification such as solar, wind and batteries have been falling for over a decade and this deflation has made electrification increasingly competitive. However, attention has now turned not just to policy steps to unblock the bottlenecks that stand between falling costs and actual deployment by addressing issues such as permitting, grid connection, and transmission build out, but also to develop and scale the technologies that are required to electrify high-temperature industrial processes, which has been more challenging to date.

[1] EIA (June 2025). Amid regional conflict, the Strait of Hormuz remains critical oil chokepoint
[2] BNEF (February 2026). Battery storage costs reach record lows as costs of other clean technologies increased
[3] European Commission (June 2026). Electrify Now – a global initiative
[4] IEA (June 2025). World Energy Investment 2025

1 / Performance dashboard

The dashboard summarizes key financial indicators relevant to the energy transition. It presents quarterly and annual performance data for commodity indices and climate transition commodities, including carbon prices. It therefore provides an overview as to how transition-linked assets are performing relative to broader commodity trends.

1.1 The strength in clean energy transition and commodity indices continues

The strength of clean energy and climate index benchmarks from 2025 has continued into the first half of this year, with the S&P clean energy transition index posting 30% gains year to date.[5] This has benefited from ongoing data centre power demand trends as well as from the broader electrification investment theme. This year has also seen a reversal in regional carbon price trends with European carbon prices surrendering some of their 2025 gains, whereas Chinese carbon prices have posted a slight recovery after last year's weakness. In Europe, attention is focused on ETS reforms to be announced this month which if previous policy announcements are a guide might help to reverse carbon prices weakness in the first half of the year.[6]

Among the energy transition commodities, the old adage that last year's winner is at risk of becoming this year's loser and vice versa seems to be applicable for cobalt and lithium. After rising in excess of 100% last year, the strength in cobalt prices has stalled so far this year. In contrast, the lackluster performance in lithium prices in 2025 has given way to a doubling in prices in the first half of 2026, in part driven by supply disruptions in China and Zimbabwe.[7]

Figure 1: Climate and commodity dashboard

Index or commodity name	1Q 2025	2Q 2025	3Q 2025	4Q 2025	2025	1Q 2026	2QTD 2026	YTD 2026
MSCI world climate benchmarks								
MSCI world net total return USD Index	-1.8%	11.5%	7.3%	3.1%	21.1%	-3.6%	11.8%	7.8%
MSCI world select screened net USD index	-2.7%	11.8%	7.2%	3.3%	20.6%	-4.5%	12.4%	7.3%
MSCI world select sustainability screened CTB net USD Index	-2.2%	11.3%	7.2%	3.2%	20.4%	-4.8%	12.5%	7.2%
MSCI world low carbon SRI selection net USD Index	-4.9%	13.8%	7.0%	3.4%	19.8%	-7.6%	12.8%	4.3%
Other climate benchmarks								
S&P global clean energy transition index (USD) NTR	-0.2%	15.9%	18.4%	7.2%	46.8%	10.0%	13.9%	25.3%
Solactive ISS ESG emerging markets net zero pathway index NTR	2.6%	14.5%	14.1%	5.0%	40.8%	2.2%	26.5%	29.2%
Solactive ISS ESG developed markets net zero pathway index NTR	-2.3%	11.4%	6.9%	3.2%	20.2%	-5.9%	13.9%	7.2%
Carbon markets								
EU EUA 1M future (€)	-6.9%	2.3%	11.0%	13.2%	19.8%	-16.6%	7.3%	-10.5%
China carbon price (CNY)	-11.7%	-12.9%	-22.7%	28.7%	-23.4%	6.6%	2.1%	8.8%
Industrial metals								
LME 3M copper (US$)	10.7%	1.6%	4.0%	21.0%	41.7%	-0.7%	9.3%	8.5%
LME 3M aluminium (US$)	-0.7%	2.5%	3.2%	11.8%	17.4%	15.7%	1.0%	16.9%
LME 3M nickel (US$)	3.8%	-4.4%	0.1%	9.3%	8.6%	2.8%	3.4%	6.3%
Strategic metals								
Cobalt LME spot (US$)	38.3%	-2.1%	5.1%	53.0%	117.8%	5.5%	0.0%	5.6%
Gold (US$)	19.0%	5.7%	16.8%	11.9%	64.6%	8.1%	-9.5%	-2.2%
Uranium 308 spot price (US$)	-9.2%	22.9%	5.2%	-2.1%	14.9%	2.8%	3.3%	6.2%
Lithium carbonate CIF swap	-7.7%	-16.1%	18.5%	10.4%	1.4%	84.0%	9.3%	101.0%
Fossil fuels								
Thermal coal (US$/MT)	-6.7%	3.4%	-11.6%	2.5%	-12.6%	23.7%	4.8%	29.6%
WTI crude oil (US$/bbl)	0.1%	-9.3%	-1.1%	-9.2%	-18.5%	94.5%	-27.0%	42.1%
European natural gas (€/MWh)	-17.0%	-20.2%	-3.9%	-5.0%	-39.6%	70.5%	-7.9%	57.0%

Source: Bloomberg Finance LP (30 June 2026).

[5] Bloomberg Finance LP (June 2026)
[6] DWS Research Institute (May 2026). Investing in carbon before policy reforms
[7] Bloomberg Finance LP (June 2026)

2 / The big picture

2.1 Strait of Hormuz: Energy security is repricing the transition

Major disruptions often drive changes that gradual policy frameworks cannot. Tensions in the Middle East and broader trade fragmentation are reshaping how markets approach the energy transition. What was once framed as a linear substitution–replacing fossil fuels with renewables–is increasingly being reframed. Geopolitical shocks are repeatedly reminding markets that security of supply is a first-order constraint, and that the system's reliability attributes–firm capacity, storage, grids and flexibility–are now as critical as, if not more than, carbon intensity.

Chokepoint risks such as the Strait of Hormuz are accelerating this repricing, reinforcing the shift toward more domestic, electrified and diversified energy systems. This is particularly acute in import-dependent emerging markets, where energy shocks quickly translate into inflation, current account pressure and political stress, triggering policy shifts. Southeast Asia illustrates this vulnerability. Despite accounting for around 9% of the global population and 4% of GDP, the region is expected to drive nearly 20% of energy demand growth to 2035, while remaining heavily reliant on Middle Eastern supply across crude, gas and refined products. Prior to the current crisis, around 60% of crude oil imports and one-third of gas imports were sourced from the Middle East, with nearly 45% of refined product supply linked to Middle Eastern crude.[8]

The current shock is already feeding into higher energy bills and macro risk, with the region's import bill potentially rising from US$80bn in 2024 to US$160bn in the near term and reaching US$400bn by mid-century under current policies.[9] Importantly, the response is not a reversal of the transition, but an acceleration driven by renewables, electrification and storage, with transition capacity emerging as a core energy security variable.

Capital flows reflect this shift. The IEA expects global energy investment to reach US$3.4 trillion in 2026, with approximately US$2.2 trillion in clean energy, nearly double fossil fuel spending. Solar alone is attracting approximately US$365bn annually (~US$1bn/day), while oil investment continues to decline and gas spending rises modestly.[10] However, the transition remains uneven, with advanced economies and China accounting for over 70% of investment, with China accounting for around US$940 billion, or 28%.

While capital flows capture the supply-side shift, early indicators suggest demand-side behaviour may also be adjusting. Figure 2a shows that between Q1 2025 and Q1 2026, EV sales rose by 80% in Asia Pacific, and China's solar exports increased by 120% to Africa and 150% to Southeast Asia. In India, LPG disruptions may have been partly behind the 10–15x surge in induction cookstove adoption, highlighting how quickly consumers can switch to electric alternatives when supply risks materialise. Electrification is also emerging as a real-time response to energy security shocks. Figure 2b shows countries' policy actions due to the energy price crisis, showing that many of the emerging market economies in Asia, which have been particularly exposed to the closure of the Strait of Hormuz, are strengthening their structural policies that will lead to reduced fossil energy use and faster electrification. These include not just consumer support measures such as price caps and cuts in fuel taxes but also energy conservation steps and structural policies to encourage electrification and energy efficiency.

Figure 2a: Electrification demand indicators

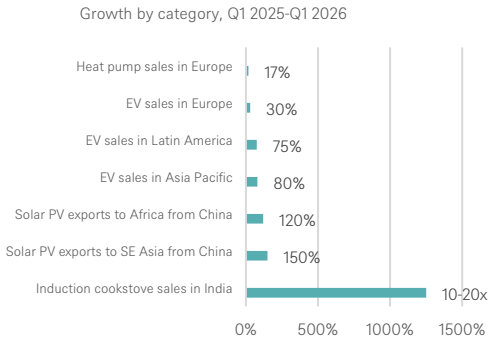
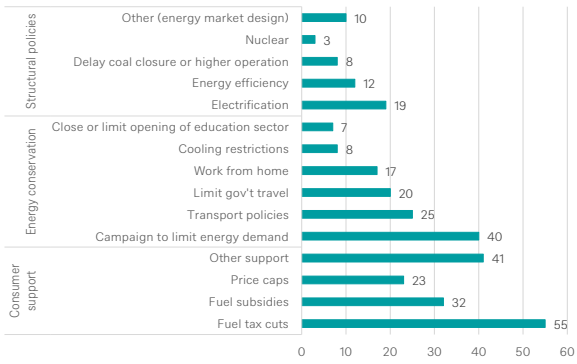


Figure 2b: Country responses to energy shocks



Source: IEA, Carbon Brief, DWS Research Institute (June 2026).

[8] IEA (une 2026) Southeast Asia Energy Outlook 2026
[9] IEA (June 2026) Strait of Hormuz crisis reinforces need for Southeast Asia to tackle major energy vulnerabilities
[10] IEA (May 2026) World Energy Investment 2026

2.2 Electrification has emerged as a system-level hedge against fossil fuel volatility to improve energy security

Renewables and electric technologies like heat pumps and EVs are no longer just a climate solution—they have become a strategic energy security asset. Electricity's share of final energy consumption has risen to 21% (from ~18% in 2015), with electricity demand growing about ~2.3x faster than total energy demand last year.[11] While electrification has been most pronounced in China, it is now accelerating globally, signalling a clear structural shift toward electricity-led systems.

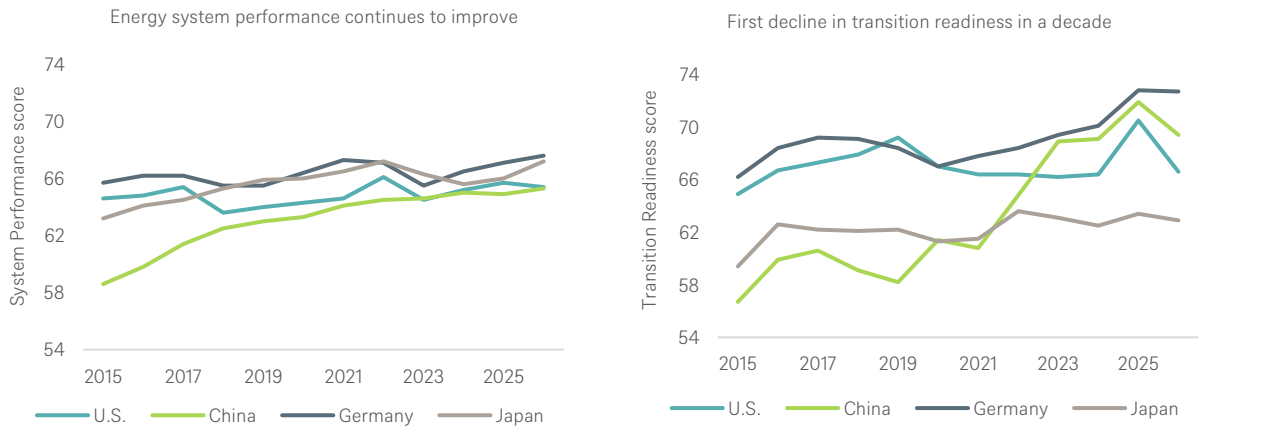
The mix is also becoming cleaner. In 2025, renewables overtook coal as the largest source of electricity (34% vs 33%), with solar generation up around 30% versus the previous year.[12] Global solar output is now comparable to total EU-27 electricity demand, with China driving over half of the growth. The shift is also evident in the US, where solar surpassed coal for the first time in May 2026 (12.8% vs 12.2%). Over five years, coal's share has nearly halved, while solar's has more than doubled.[13] This marks a structural inflection: marginal energy demand is increasingly met by domestic, relatively price-stable electricity rather than fuels. However, while electrification is scaling rapidly, the systems required to support it are not keeping pace.

2.3 The "missing link" in a security-led energy transition: real-economy constraints on electrification

The World Economic Forum's *Energy Transition Index 2026* benchmarks 120 countries using 44 indicators across two weighted pillars: system performance (60%), covering current energy security, equity and sustainability outcomes, and transition readiness (40%), covering the policy, finance, infrastructure, innovation and human-capital conditions needed for future progress. Scores are normalised on a 0–100 scale and are best interpreted as a structural measure of whether today's energy-system gains are supported by the enabling capacity required to sustain electrification and decarbonisation. Example indicators include household and industry electricity prices, import dependence, electricity reliability, energy and emissions intensity, clean-energy share, policy stability, renewable investment, grid and digital infrastructure, AI readiness, R&D and clean-energy workforce capacity.

While electrification is accelerating, the enabling conditions required to sustain it particularly grid capacity, system flexibility and regulatory stability, are not keeping pace. The WEF's analysis highlights the disconnect: despite record investment, overall transition progress has effectively stalled, with ETI scores broadly flat.[14] This reflects a divergence between improving *system performance*[15] (+0.43%), and a decline in *transition readiness*[16] (-0.76%), marking the first fall in over a decade. Taken together, this suggests energy systems continue to deliver incremental improvements, but the enabling conditions required to sustain future progress need to be addressed through more forceful policy action, which we explore in the next section.

Figure 3: Near-term progress continues, while long-term transition readiness weakens in 2026



Source: World Economic Forum (ETI 2026), DWS Research Institute (June 2026).

[11] IEA (April 2026) Global Energy Review 2026
[12] Ember (April 2026) Global Electricity Review 2026
[13] Ember (June 2026) Solar overtakes coal in US electricity for the first month on record
[14] World Economic Forum (June 2026) Energy Transition Index 2026
[15] System Performance Score *(measured on a scale of 0–100, where 100 represents the highest possible score)* reflects how effectively a country's energy system performs across the three dimensions of sustainability, energy security, and energy equity. It is derived from 24 indicators that collectively provide a comprehensive assessment of current energy system performance.
[16] Transition Readiness Score (measured on a scale of 0–100, where 100 represents the highest possible score) reflects how well positioned a country is to support and accelerate the energy transition. It is derived from 22 indicators that assess key enabling factors, including regulatory and policy frameworks, infrastructure, capital and investment availability, innovation capacity, and human capital, providing an assessment of a country's preparedness for future transition needs.

While part of the decline is cyclical, driven by higher interest rates, fiscal tightening and policy uncertainty, the broad-based deterioration across finance, regulation, innovation and infrastructure signals deeper structural constraints. As shown in Figure 3, the divergence between system performance and transition readiness is widening across leading economies, highlighting a growing gap between capital deployment and delivery capacity.

One of the main constraints is in electricity networks. Grid investment (~US$400 billion annually) continues to lag generation spending (~US$1 trillion), creating a structural mismatch between capacity build-out and system integration. This gap represents the "missing link" in the transition explaining uneven decarbonisation outcomes despite rising electrification and record investment and marking a structural shift from scaling supply to enabling system-level delivery.

3 / Policy watch

3.1 The bifurcation of electrification policies around the world

Electrification has become a central pillar of the global energy transition, but the policy frameworks behind it are splitting into two camps. China, the world's largest energy investor, treats electrification as a core part of its industrial and energy-security strategy: electricity already supplies almost a third of its final energy.[17] Europe provides the second durable framework, where REPowerEU, grid and industrial policy and high carbon prices are supporting investment along the new and emerging energy value chain. In comparison, the U.S. at a federal level is the outlier. The unwinding of Inflation Reduction Act incentives, cancelled federal funding, and weakening vehicle and efficiency standards have introduced headwinds to the pace of electrification, particularly in the transport sector.

3.2 China aims to secure its spot as the world's leading electric economy

China has become one of the world's leading examples of large-scale electrification, with electricity already supplying close to one-third of final energy demand and rising significantly faster than in most major economies. The country has simultaneously become the world's largest clean-energy investor, the largest market for electric vehicles and batteries, and the dominant manufacturer of many of the technologies required for electrification, including solar modules, batteries and power equipment.[18]

This has been achieved by the interaction of multiple reinforcing strategies: long-term planning through Five-Year Plans that integrate energy, industry, and economic objectives. It includes a target of 50% non-fossil fuel generation by 2030 and 25% non-fossil energy consumption. Moreover, it encompasses significant investment. China State Grid has announced RMB 4+ trillion (EUR 480-560bn) investment over the 2026-2030 period which include investment for ultra-high voltage transmission,[19] accelerating smart-grid construction, improving distribution grids, scientifically deploying pumped hydro, and developing new energy storage, as well as raising the electrification level of end-use energy consumption including by promoting low-carbon substitution in transport and speeding up electrification in the freight sector.

China's government has also identified power supply for AI data centres as a strategic priority and has committed to stronger integration between computing infrastructure and electricity networks. Authorities want renewable energy to provide approximately 80% of data-centre electricity consumption by 2030, versus just 11% in 2023.[20] By combining industrial policy, clean-energy deployment, grid modernisation and digital infrastructure development into a coherent national strategy, China is demonstrating how electrification can evolve from a climate objective into a broader model for economic transformation.

3.3 Europe to set its first electrification target

Europe's policy architecture is not just focused on increasing electrification rates across the buildings, transport, industrial and digital sectors but also to target and address different bottlenecks along the value chain. For example, the EU has extended permitting reform to industrial facilities in strategic sectors. The Net-Zero Industry Act streamlines approval for clean-tech manufacturing plants, the Critical Raw Materials Act does the same for extraction, processing and recycling projects, and the proposed Industrial Accelerator Act would broaden the logic of faster planning approvals to a wider set of industrial manufacturing facilities.

Planning reforms are core to the 2023 EU Action Plan for Grids, which recognised that grid expansion had become a critical constraint on electrification and industrial competitiveness. Subsequent Commission guidance on anticipatory grid investment, encourages transmission and distribution networks to plan and invest before for future electricity demand appears, rather than just reacting to existing connection requests. The EU estimates that investments of EUR730bn for power distribution and EUR477bn for transmission grid are needed by 2040.[21]

[17] EnerData (2024) latest data as of May 2026
[18] Carbon Brief (February 2026). Analysis: Clean energy drove more than a third of China's GDP growth in 2025
[19] State Grid (22 January 2026)
[20] Carbon Brief (April 2025). Explainer: How China is managing the rising energy demand from data centres
[21] European Commission (March 2026). European grids

This summer the EU will set its first electrification target. Under its Electrification Action Plan (EAP). It will establish a target to raise electricity's overall share of final energy consumption to 32% by 2030, from just over 20% currently.[22] In addition, electrification targets will be set for the transport, buildings and industrial sectors. Measures will also include improving the economics of electrification for example by reduction electricity taxes and levies relative to fossil fuels as well as efforts to strengthen industrial competitiveness, for example scaling manufacturing of grid and power equipment. Later in 2026, the Commission will also propose the post-2030 policy framework and targets for renewables and energy efficiency.

3.4 A more complex policy environment in the U.S.

At the federal level, the policy environment has reversed sharply over the past 18 months. The One Big Beautiful Bill Act dismantles much of the electrification-support architecture erected under the Inflation Reduction Act, cutting projected clean-energy incentives by roughly US$496 billion between 2025 and 2034.[23] The rollbacks fall hardest on the demand side of electrification: consumer EV credits were terminated for vehicles acquired after September 2025, the residential clean-energy and home-efficiency credits were rescinded at the end of last year, EV charging credits lapsed at the end of last month while solar and wind investment and production credits are facing an accelerated phase-out.

Even so, the federal picture provides a distorted view, because the pace of electrification and clean-power development is set far more by states and grid operators than politicians in Washington. Texas is the clearest example. In 2025, solar overtook coal to become the third largest source of generation on the ERCOT grid, at roughly 14% of supply against coal's 13%.[24] Texas added roughly 11GW of new solar capacity last year, or roughly the state's combined additions from the previous two years. This occurred even as national installations fell 14% under the weight of the federal rollback.

[22] European Commission (November 2025). Electrification
[23] Peterson Foundation (March 2026). Energy tax policy under the OBBBA
[24] Reuters (December 2025). Texas makes clean power breakthrough as solar output overtakes coal

4 / Technology & innovation tracker

4.1 Innovation and its cost curve implications

Innovation matters for three reasons: First it is a demand accelerator as falling costs pull adoption forward and expands the market as more demand streams emerge. This is illustrated by declining cost curves for core electrification technologies such that since 2010, the levelized cost of utility-scale solar and lithium-ion battery fell by roughly 90%, with onshore wind down around 70%.[25] Second, innovation is a moat shifter, as innovation decides who captures value along the energy value chain and finally innovation is a disruption risk as it can re-rate incumbents and strand legacy assets.

One way to assess the development and likely pace of electrification innovation is by type, maturity and sector application. Figure 5 presents innovative technologies across three horizons: scaling (commercial today), inflecting (nearing viability) and emerging (early stage) and in which sector these are and will be deployed. One of the main findings is that the commercial readiness of electrification technologies is broad and covers all sectors from BEV passenger cars in transport, heat pumps in buildings, to electric motors in the industrial sector. However, for inflecting technologies it appears that deployment and financing may be the key challenge. Moreover, where genuine technological immaturity exists, it typically clusters around a small set of issues such as high temperature process het, which remains industry's binding hard-to-abate constraint. It also exists in other areas such as long-haul trucking in transport, thermal storage for buildings and next generation cooling for data centres.

Figure 5: Technology by type and maturity along the energy value chain

	Fuel switching: electricity displacing oil and gas at the point of use			*Net-new load*
	Transport	Buildings	Industry	Digital
Scaled	BEV passenger cars Electric buses Public AC/DC charging	Heat pumps LED lighting Induction cooking	Electric motors & drives Scrap-steel arc furnaces Low-temperature process heat	Hyperscale electrical infrastructure UPS systems Grid interconnection
Inflecting	Medium duty commerical EVs DC fast-charging networks Two- & three-wheelers	Mass-market retrofit heat pumps Rooftop solar & behind-the-meter storage Smart thermostats & controls	Electrode & electric boilers Mechanical vapour recompression Mid-temperature process heat	Liquid cooling On-site/behind-the-meter generation Data centre-scale storage
Emerging	Long-haul electric trucking Megawatt charging Solid-state batteries	Grid-interactive efficient buildings Thermal storage Networked geothermal	High-temperature process heat Thermal batteries At-scale H_2 electrolysis	SMRs for data centres Immersion cooling AI-optimised flexible load/demand response

Source: DWS Research Institute (July 2026).

4.2 Tracking innovation metrics around the world

To assess innovation developments, we track the strength of national and regional energy-innovation ecosystems using a small set of measurable indicators: public clean-energy RD&D, low-carbon patenting, cost curves, private capital flows and deployment milestones, Figure 6. These metrics are intended to capture the full innovation chain, from early-stage public research, to intellectual property formation, to cost reduction, private-sector scaling and first-of-a-kind commercial deployment.

[25] IRENA (June 2025). Renewable power generation costs in 2024

Figure 6: Metrics to track energy-innovation ecosystems by country/region

	United States	European Union	China	Japan
Government spend on clean energy R&D Level, intensity and direction of travel	**Mixed/Transition** — large innovation system, but federal energy R&D budget dipped in 2025 and priorities are being reoriented.	**Leader** — Europe reached ~0.08% of GDP in public energy R&D, closer to the 0.1% benchmark than the US/Japan.	**Strong** — public energy R&D is on par with Europe in level, around ~0.07% of GDP by IEA estimate.	**Moderate / Stable** — Japan reported 2024 R&D equivalent to 0.033% of GDP; its largest R&D areas are nuclear, energy efficiency and fossil fuels.
Low-carbon patents 2–3 year lead indicator of commercialisation	**Strong but slowing** — U.S. energy technology patenting fell by 10% between 2022 and 2023, though the US remains diversified across technology areas.	**Mixed** — Europe recorded a third consecutive annual decline, with energy patenting down 28% over 2022–2023	**Leader** — Chinese inventors made double the number of international energy patent applications in 2023 versus 2020, reaching twice the level of the US, Japan or Europe.	**Battery specialist/Strong** — Japan has the highest revealed technology advantage in batteries among major economies, and after China patents more in low-carbon energy areas than any other country.
Cost curves Cost decline per doubling of cumulative capacity	**Strong niches** — U.S. strengths are visible in advanced technologies such as next-generation geothermal, batteries, grid resilience and aviation.	**Mixed** — Europe has innovation strengths, but clean-tech production-cost gaps versus China in areas such as battery cathodes, wind blades and cement.	**Leader** — China is used as the benchmark comparator for clean-tech manufacturing cost gaps, reflecting its scale and manufacturing-cost advantage.	Japan is highly specialised in battery innovation and advanced chemistries, but Japan is not considered a cost benchmark across clean-tech manufacturing.
Private capital VC, PE and growth funding into energy tech by sub-sector	**Leader** — nearly 50% of global energy VC in 2025 was raised by U.S. start-ups, and U.S. start-ups typically raise larger rounds faster than European peers.	**Strong** — European start-ups accounted for 25% of global energy VC in 2025, and Europe hosted more than 40% of energy start-ups raising first funding rounds.	**Mixed/Transition** — China accounted for less than 10% of global energy VC in 2025, its lowest level since 2014, despite strong corporate R&D.	Japan is not highlighted as a major energy VC geography; its strength is better evidenced through corporate innovation, patents and technology milestones rather than start-up capital.
Deployment milestones TRL progression and FOAK commercial plants reaching FID / operation	**Strong** — the U.S. accounts for 20% of projects in the more advanced phases of the IEA Races to First; 2025 highlights include geothermal drilling, lithium-ion battery improvements and novel aviation designs.	**Leader** — Europe accounts for 40% of projects in the more advanced phases of the IEA Races to First, with highlights in fusion, hydrogen storage, industrial electrification, grid stabilisation, CO_2 storage and synthetic fuels.	**Strong/Fast-moving** — China achieved multiple 2025 milestones, including perovskite solar tandem-cell efficiency, kilowatt-scale solid-state air conditioning and a planned 50 MW floating wind turbine.	**Strong specialist** — Japan is well placed in solid-state batteries, perovskites, fusion and hydrogen-based fuels; a Japanese company completed the first full-scale testing of an ammonia ship engine in 2025.

Source: IEA (February 2026). The State of Energy Innovation 2026; DWS Research Institute (July 2026).

We find that the U.S. remains a deep and broad energy-innovation ecosystem, particularly strong in venture capital, start-ups and advanced technology niches such as geothermal, batteries, aviation and grid technologies. However, the U.S. classification is "mixed/transition" on public RD&D because the IEA notes that the U.S. federal energy R&D budget dipped by 8% in 2025, with some spending paused or cancelled during a review of research priorities. In contrast, Europe stands out as the leader in public RD&D intensity and advanced demonstration activity, with public energy R&D reaching around 0.08% of GDP and Europe accounting for 40% of advanced-phase IEA "Races to First" projects. At the same time, Europe's innovation system still needs stronger patent momentum and scale-up capital, as the IEA highlights recent declines in European energy patenting and smaller start-up funding rounds versus the U.S.[26]

China is the leader on patenting scale, manufacturing cost position and deployment momentum, with Chinese inventors doubling international energy patent applications between 2020 and 2023 and reaching twice the level of the US, Japan or Europe. Meanwhile, Japan is best characterised as a specialist innovation leader, particularly in batteries and selected advanced technologies: the IEA notes that Japan has the highest revealed technological advantage in batteries among major economies and strong positioning in solid-state batteries, perovskites, fusion and hydrogen-based fuels.

Overall, the table suggests a differentiated innovation map: the U.S. leads on private capital and start-ups, Europe leads on public RD&D and FOAK deployment, China leads on patenting and manufacturing scale, while Japan provides focused strength in batteries and advanced clean-energy technologies with further work needed on policy stability in the U.S., scale-up finance in Europe, broader VC depth in China and Japan, and more comparable cost-curve data across all regions.

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5 / Conclusion

Summary of key findings

1. Electrification is becoming a system-level hedge against fossil fuel volatility. Electrification is no longer simply a decarbonisation pathway, but a strategic response to fossil fuel price and supply shocks, particularly in regions exposed to imported oil and gas.
2. Early demand-side evidence suggests consumers and markets are already responding to supply risk. This year has witnessed sharp increases in electrification-linked demand indicators, including EV sales in Asia Pacific, Chinese solar exports to Africa and Southeast Asia, and induction cookstove adoption in India following LPG disruptions.[27]
3. Policy frameworks are increasingly bifurcating across regions. China and Europe are embedding electrification into industrial, energy-security and grid strategies, while the U.S. faces greater policy uncertainty amid IRA-related funding reversals, cancelled federal funding and weaker vehicle and efficiency standards
4. Innovation remains the critical lever determining the speed and breadth of electrification. Cost declines in solar, batteries and wind have already expanded electrification markets,[28] while future opportunities will depend on progress across scaling, inflecting and frontier technologies.
5. Country-level innovation strengths are increasingly differentiated. The U.S. leads in venture capital and start-ups, Europe in public RD&D and first-of-a-kind deployment, China in patenting and manufacturing scale, and Japan in batteries and selected advanced clean-energy technologies.[29]

Investor implications

1. Grid infrastructure and flexibility are becoming binding constraints and therefore investable bottlenecks. Transmission, distribution, storage, grid stabilisation and demand-side flexibility are likely to become increasingly central as electrification demand outpaces grid build-out.
2. Value capture may favour equipment and enabling infrastructure over commoditised generation. There exists multi-year backlogs in transformers, turbines and cables, while cost-curve advantages have become especially important for power generation.
3. Regional policy divergence creates both opportunity and execution risk. China and Europe offer more durable policy frameworks for electrification, while the U.S. presents strong private-sector innovation but greater policy uncertainty. This argues for differentiated regional risk premia rather than a single global electrification view.
4. Innovation analysis should move beyond headline clean-tech exposure. Investors should distinguish between mature scaling technologies, technologies nearing commercial inflection and frontier technologies, as each carries different risk, timing and return characteristics.

[27] Carbon Brief (April 2026). Iran war analysis: How 60 nations have responded to the global energy crisis
[28] BNEF (February 2026). Battery storage costs reach record lows as costs of other clean technologies increased
[29] IEA (February 2026). The State of Energy Innovation 2026

6 / DWS sustainability research library

Below we provide links to recent DWS research papers relating to themes and asset classes relevant to the energy transition.

CIO Office

- Critical minerals – The power factor in commodities (June 2026)
  Critical minerals – The power factor in commodities | DWS
- Gateway to Europe (September 2025)
  CIO View: Gateway to Europe | DWS

DWS Research Institute

- The new energy system energy: Navigating the shift from molecules to electrons (May 2026)
  The new energy system : Navigating the shift from molecules to electrons | DWS
- Investing in carbon before policy reforms (May 2026)
  Investing in carbon before policy reforms | DWS

European Transformation

- Financing German first-of-a-kind technologies critical to Europe's future (March 2026)
  Financing German first-of-a-kind technologies critical to Europe's future | DWS
- European Transformation research hub
  www.dws.com/en-gb/insights/global-research-institute/european-transformation-research-hub/

Infrastructure

- European Midmarket infrastructure: 10 reasons it matters for portfolios (May 2026)
  European Midmarket Infrastructure: 10 Reasons It Matters for Portfolios | DWS
- Defence Infrastructure: Europe's opportunities (February 2026)
  Infrastructure | DWS

Real Estate

- Europe property performance monitor (June 2026)
  Europe Property Performance Monitor | DWS
- Real estate strategic outlooks: Mid-Year 2026 (June 2026)
  Real Estate Strategic Outlooks: Mid-Year 2026 | DWS

Important information – EMEA, APAC & LATAM

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Contributors

Murray Birt
Senior Sustainability Strategist

Jay Joshi
DWS Research Institute

Abhishek-r Mittal
CROCI Investment Strategy & Valuation Group