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The Just (Energy) Transition Paradox: Record Investment, Declining Readiness



Sustainability Research Paper

The Al-Attiyah Foundation



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A just energy transition has two purposes: to replace high-emission energy with cleaner supply and to protect those whose employment, income or access to energy the change may harm. Spending has been considerable. The International Energy Agency (IEA) recorded USD 3.3 trillion of energy investment in 2025, of which USD 2.3 trillion went to clean energy. However, spending alone has not secured the intended results. The World Economic Forum (WEF) Energy Transition Index recorded in 2026 the first fall in transition readiness in more than a decade. Finance and investment, regulation and political commitment, and innovation all weakened, and gains in equity and sustainability were offset by lower energy security after the disruption of the Strait of Hormuz. How can transition finance be converted from pledges and commitments into operational projects? What financial instruments, policies and risk-management systems are needed to support a just and resilient transition?

SUSTAINABILITY RESEARCH PAPER

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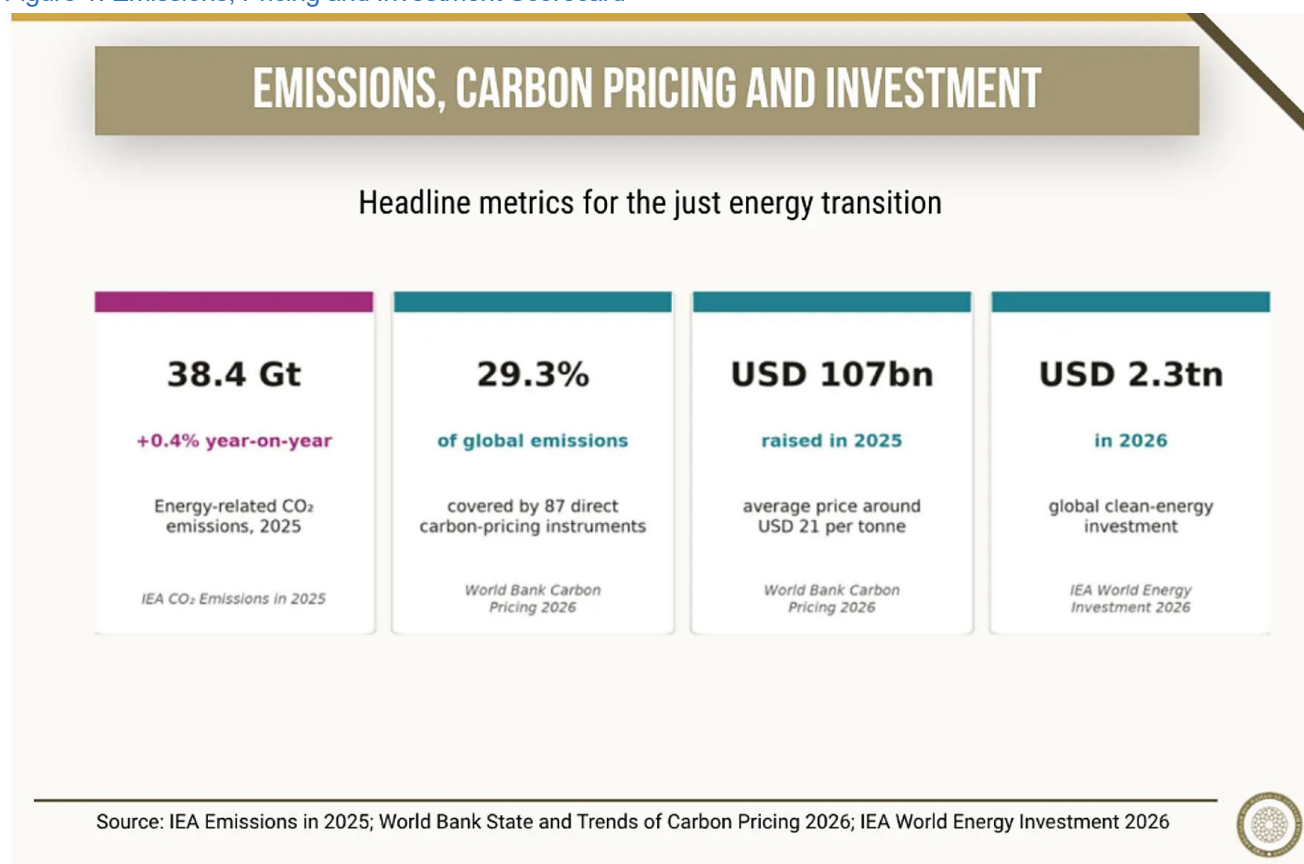


- World energy investment reached a record USD 3.3 trillion in 2025, of which USD 2.3 trillion went to clean energy. In the same year, measured transition readiness fell for the first time in more than a decade. The constraint has moved from the availability of capital to the conditions that allow capital to be deployed.
- Four of the five readiness dimensions of the WEF Energy Transition Index have recently deteriorated. These include finance and investment, which fell furthest, by 1.8%, followed by regulation and political commitment at 1.2% and innovation at 1.1%.
- The diffusion of environment-related technologies declined for the tenth consecutive year, while only education and human capital improved. System performance barely rose, because gains in equity and sustainability were offset by a 0.9% fall in energy security after the disruption of the Strait of Hormuz in 2026.
- The delivery of energy transition has become physically constrained. More than 2,500 gigawatts of projects wait in grid connection queues worldwide, so permitting and network capacity, not finance, have become the immediate bottleneck. About three-quarters of clean energy investment flows to a small group of markets and developing economies pay financing costs two to three times those of advanced economies.
- Access, which is the first test of a just transition, remains unequal. Renewable generating capacity stood at 33.6 watts per person in low-income countries, compared with 1,224 watts in high-income countries according to the latest globally verified data (for 2024).

- Some 655 million people lacked electricity and about two billion cooked with polluting fuels. Public clean energy flows to the least developed countries fell 11% to USD 3.7 billion in 2024 and about 80% of flows to developing countries took the form of debt.
- There is concern that pledged finance has outpaced actual allocations. As at 31 March 2026, South Africa had recorded USD 14 billion in pledged finance, of which 43% had been allocated. Policy loans stood at 92% and grants at 87% of availability, but concessional loans stood at 33% and highly concessional loans had not been drawn at all.
- Progress elsewhere was uneven, with Indonesia approving only USD 3.1 billion of USD 21.8 billion committed and, in December 2025, abandoning the planned closure of the Cirebon-1 coal plant.
- Corporate transition capital has also been withdrawn. Low-carbon capital expenditure among the oil and gas majors fell from about 19% of spending in the 2024 financial year to about 14% in 2025. Corporate purchases of clean power fell for the first time in nearly a decade and became increasingly concentrated among technology buyers.
- Mandatory measurement is moving in two directions. By illustration, EU Directive 2026/470 narrowed European sustainability reporting and due diligence obligations from March 2026, while the Qatar Central Bank imposed the first binding International Sustainability Standards Board mandate in the GCC, applying to licensed banks and insurers from 1 January 2026.
- The credibility of a just energy transition now depends on verifiable delivery. For hydrocarbon-weighted economies (including Qatar as the strongest MENA performer on the WEF Energy Transition Index), key signs of progress include tangible financial allocations, installed capacity, verified workforce outcomes, transparent benefit sharing and monitoring that withstands external review.



Figure 1. Emissions, Pricing and Investment Scorecard

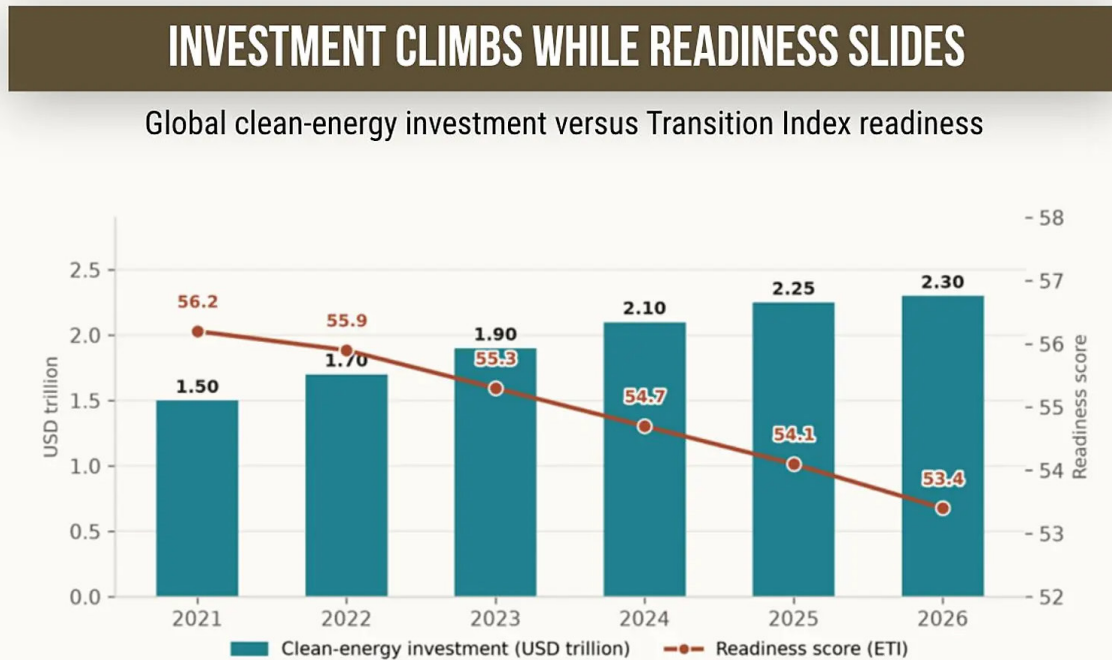


Three resources govern the delivery of the energy transition: finance, existing assets and skilled labour. Although they interact, they are economically distinct. Grid delays reduce project revenue, and weaker revenue raises the cost of finance. Falling demand for high-emission output shortens the working lives of existing assets and brings forward impairment. Costlier finance and earlier write-downs together narrow the capacity for retraining and community support. Each risk therefore needs to be measured separately before their combined effects can be judged.

The first financial risk is the gap between announced support and money available to projects, as the Just Energy Transition Partnerships show it clearly. South Africa's sixth quarterly progress report recorded USD 14 billion pledged and USD 6 billion allocated as of 31 March 2026, an allocation rate of 43%.

Allocation varies sharply by instrument: policy loans stood at 92% and grants at 87%, but concessional loans at 33% and highly concessional loans at 0%. Implementation tells a steadier story. Across the 257 registered projects, about three-quarters of portfolio funding was being deployed or delivered.³ As another example, Indonesia has secured USD 22 billion in commitments, of which about USD 3.1 billion has been approved, against an estimated USD 97 billion of electricity decarbonisation investment required by 2030. In December 2025, the planned closure of the Cirebon-1 coal plant was abandoned.⁴ Published accounts often confuse funds pledged, allocated, approved, contracted, financially closed or disbursed, and commitments should be kept separate from estimates of long-term system need.

Figure 2. Investment Rises but Readiness Falls



Source: IEA World Energy Investment 2026 (Investment) and WEF Energy Transition Index 2026 (Readiness)



The transition also puts fossil-fuel assets at risk. Changes in policy, demand, commodity prices and technology may reduce revenue or shorten an asset's working life. For oil and gas companies, the relevant evidence includes the assumptions used to value producing fields and planned developments, the proved and probable reserves that may cease to be commercially recoverable and the sensitivity of value and operating life to changes in demand, policy and technology. The International Accounting Standards Board published illustrative examples in November 2025 showing how climate-related and other uncertainties should appear in financial statements, including the assumptions behind impairment tests and useful-life judgements.⁵

Labour is the third source of risk. The International Energy Agency (IEA) reports shortages in the technical occupations needed to build, operate and maintain energy infrastructure in its November

2025 employment report.⁶ Shortages can delay construction and raise costs even when finance is available. Movement between industries is possible but not automatic. While many oil and gas workers hold transferable skills, workers in coal-dependent regions or informal labour markets may need more time and practical support. Surveys of specific companies or regions cannot represent the global potential for labour transfer, because workforce composition, qualifications and retraining needs differ between sectors and countries.

These three risks – finance, assets and labour – decide whether planned change can proceed at the intended pace. Finance should be followed from commitment to disbursement. Fossil-fuel assets should be tested against changes in price and demand. Labour analysis should establish whether suitable skills will be available where and when they are needed.



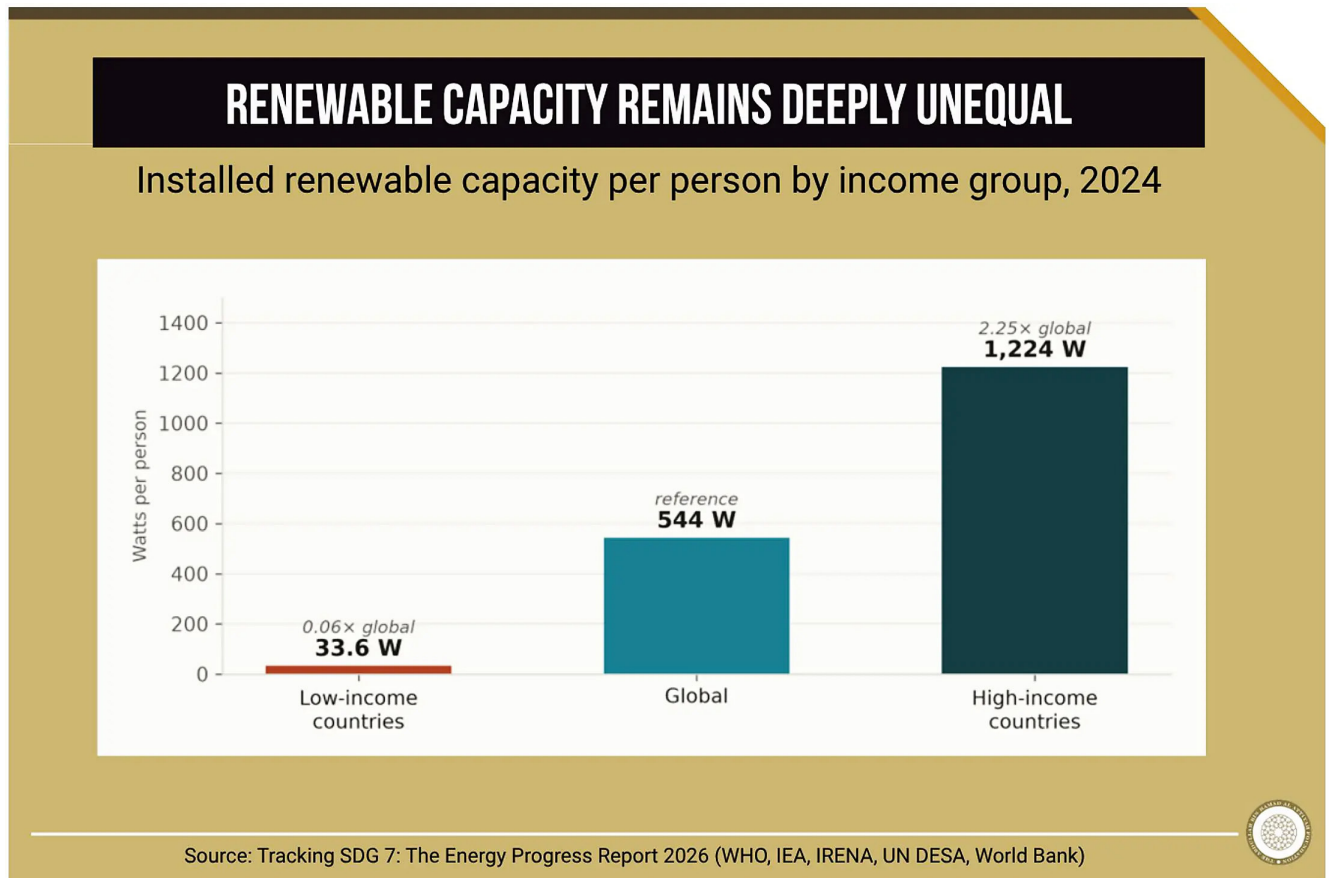
Global energy-related carbon dioxide emissions rose by about 0.4% in 2025 or about 145 million tonnes, to nearly 38.4 gigatonnes. Fuel-combustion emissions rose by about 185 million tonnes, while industrial-process emissions fell by about 40 million tonnes. The increase was slower than world economic growth, so carbon dioxide per unit of output fell again, but total energy-related emissions reached their highest recorded level.⁷

Natural gas contributed most to the rise in combustion emissions. Weak hydroelectric and wind output also raised emissions. A single year is an uncertain guide to structural change unless weather effects are separated. Nevertheless, the solar and wind plants, nuclear power, electric vehicles and heat pumps installed during the previous five years have displaced substantial fossil-fuel demand. Clean technology is changing the fuel mix even though total emissions have not fallen.⁷

Demand for copper, lithium, nickel, graphite, cobalt and rare earth elements is growing faster than the wider metals market. The main environmental effects concern water use, land disturbance and biodiversity loss, rehabilitation, tailings and the emissions intensity of refining. Circular economy measures matter here. Recycling can reduce primary demand and liabilities for rehabilitation of mining sites, but processing remains concentrated in a few countries and secondary supply will not meet demand growth this decade.⁸

Any environmental comparison of the energy transition also depends on the unit examined. Emissions per unit of electricity, per unit of industrial output and over an asset's full life reflect different policy concerns. Construction, fuel supply, operation and retirement may occur in different jurisdictions.

Figure 3. Renewable Capacity Per Person Remains Deeply Unequal



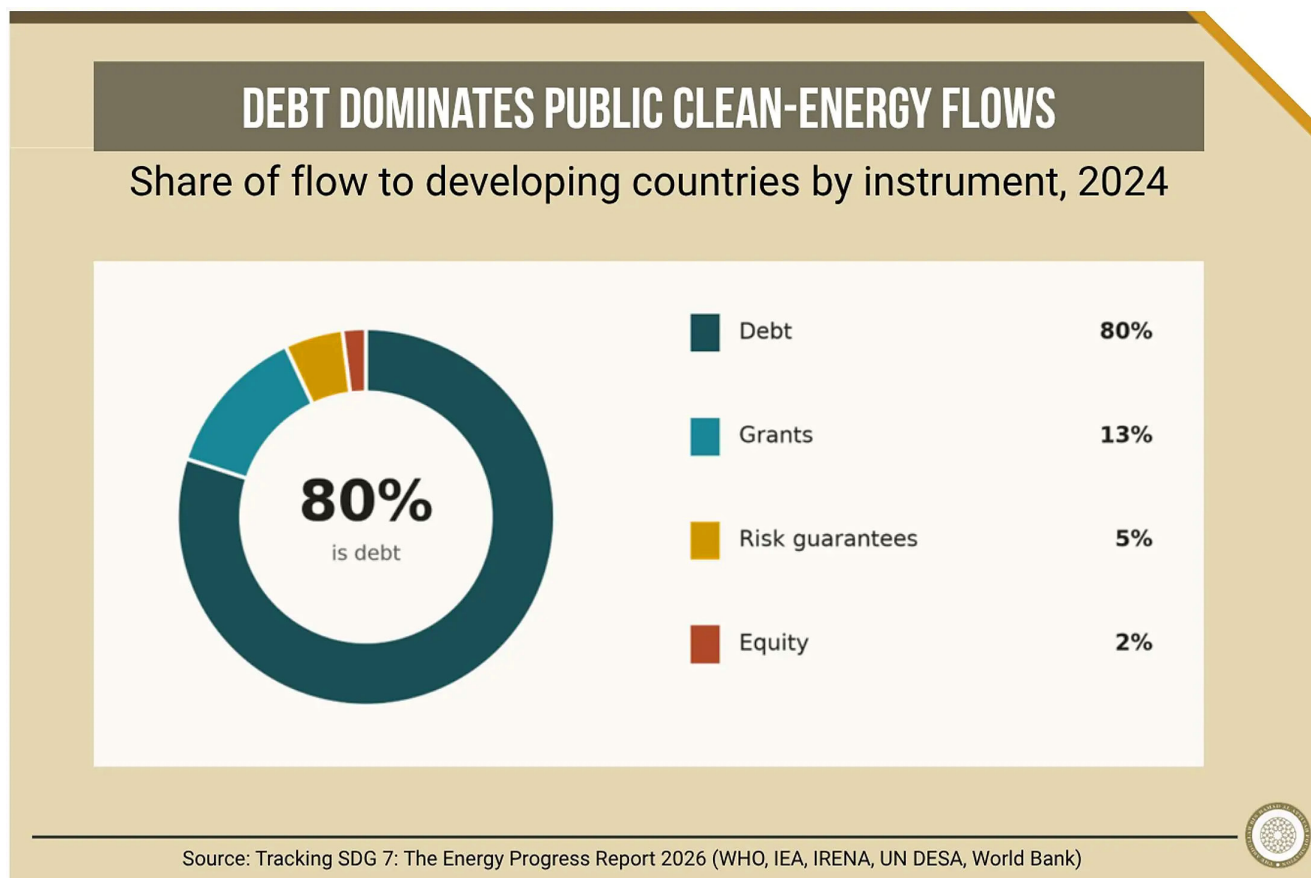
A lower operating emission rate therefore does not prove a lower total footprint unless the analysis states its period, its geographical boundary, its treatment of imported inputs and its method for attributing shared infrastructure over time. Assessment at business level needs measures tied to controlled assets and supply, such as emissions per unit of output, the share of low-emission electricity, avoided fuel use, mineral origin and rehabilitation liabilities, with stable reporting boundaries.

Based on the latest globally verified dataset, about 655 million people lacked electricity and roughly two billion relied on polluting fuels and technologies for cooking in 2024, with the shortfalls concentrated in sub-Saharan Africa and rural areas.⁹

The capacity gap is just as wide: installed renewable generating capacity stood at 33.6 watts per person in low-income countries against 1,224 watts in high-income countries and a world average of 544 watts in 2024.⁹

International public finance for clean energy remains below estimated needs, above all in low-income countries. Flows to the least developed countries fell 11% to USD 3.7 billion in 2024. The mix of instruments is as relevant as the total: debt made up about 80% of flows to developing countries, grants 13%, risk guarantees 5% and equity 2%.⁹ Where governments, utilities and households cannot sustain commercial repayment, debt may add fiscal pressure, raise tariffs, displace essential public spending or postpone the projects meant to extend access.

Figure 4. Clean Energy Flows to Developing Countries by Instrument



The social effects that determine whether the energy transition is just extend beyond domestic welfare. Overseas investment, supply contracts and development partnerships may affect household income, working conditions, communities and public institutions. Relevant evidence includes contractor and supplier performance, community consultation, worker interviews and household data. These sources show whether formal safeguards work in practice.

For the energy transition, social consequences appear in the terms on which energy reaches consumers. New generation may increase supply yet remain out of reach where tariffs exceed household means.

Concessional terms may ease the revenue burden without improving service to underserved consumers. Electricity affordability reflects generation or purchase costs, network charges, taxes and levies and their relative weight varies by market and consumer group.¹⁰ Affordability measures should separate these components and show their effect on household expenditure, arrears and disconnections, especially among lower-income consumers.

Employment and Distribution of Benefits

The wider social benefit of a just transition depends partly on whether investment creates secure employment and lasting economic value where projects are built. Renewable energy employment reached an estimated 16.6 million jobs in 2024, according to the review by the

International Renewable Energy Agency (IRENA) and the International Labour Organization (ILO), published in January 2026. Employment grew more slowly than generating capacity because of economies of scale, automation, surplus manufacturing capacity and delays in grid connection.¹¹

The location and quality of employment are as important as its quantum. Manufacturing remains concentrated in a small group of economies, while importing countries draw more of their employment from construction, installation, operation and maintenance. Jobs per gigawatt, occupational level, duration, wages and retention give a fuller account of labour benefit than gross job announcements.

Access to these opportunities is uneven. Women held about 32% of renewable energy jobs in 2024 and were less well represented in technical trades and senior management.¹¹ The imbalance narrows participation in the economic gains of the transition and may worsen shortages in occupations where employers already struggle to recruit.

Employment figures must separate temporary construction from longer-term operation, maintenance and manufacturing. Training data hold more analytical value when it includes completion, certification, placement, retention and earnings. Local-content rules may widen participation but can raise costs where suppliers cannot meet technical standards. Lasting gains accrue to labour when project pipelines and vocational training advance in tandem.

Financing Instruments and Risk Allocation

The financial question is how different instruments allocate risk and support clean energy projects. Commercial debt requires revenue sufficient for repayment under a realistic assessment of adverse conditions.





Guarantees transfer specified credit, political or payment risks, while grants support preparation, public goods and activities that cannot carry debt. The choice of instrument affects the cost of finance, project viability and how losses are shared between investors and public resources.

Physical climate risk belongs in this calculation because it can weaken transition assets and the entities that finance them. Natural catastrophes caused USD 220 billion of economic losses worldwide in 2025, of which USD 107 billion was insured. In many emerging economies, 80-90% of catastrophe losses remain uninsured.¹² Damage can interrupt revenue, impair collateral, increase default and create public liabilities, all of which reduce the resources left for investment in a just transition.

Insurance, contingent credit and guarantees cover different exposures. Insurance transfers specified physical or business-interruption losses. Contingent facilities provide liquidity after defined events and guarantees divide agreed losses among borrowers, lenders and guarantors. The remaining exposure depends on exclusions, trigger conditions, deductibles and the order in which losses are borne.

Blended finance may make projects viable where commercial capital is scarce or expensive. OECD analysis of African funds found 93 commitments to junior or first-loss tranches associated with more than USD 6.8 billion of private finance.¹³ However, this information pertains to mobilisation. It does not prove that public support caused the investment, nor does it measure social value.

Disclosure provides the information needed to price and monitor these risks. The direction of regulatory undertakings have diverged. EU

Directive 2026/470 entered into force on 18 March 2026, repealing the obligation to adopt and carry out corporate climate transition plans and narrowing the scope of sustainability reporting and due diligence. Transposition is due by 19 March 2027 for the reporting amendments and by 26 July 2028 for due diligence.¹⁴ In the opposite direction, the Qatar Central Bank issued its Sustainability Reporting Framework on 4 December 2025, applying IFRS S1 and IFRS S2 to licensed banks and insurers from 1 January 2026, with first reports covering the 2026 financial year due in 2027. This represents the first binding International Sustainability Standards Board mandate in the GCC.¹⁵ Such requirements affect assessments of project cash flow, collateral, debt service and portfolio exposure. They also impact after-tax returns.

Scenario Analysis

The financial effects described above depend on how the energy transition unfolds. Scenario analysis tests how changes in policy, technology, energy demand and physical hazards could affect asset values, cash flow, credit risk, insurance and capital. Some outlooks no longer include a pathway that stays continuously within 1.5°C. Others allow a temporary overshoot or a return to 1.5°C near 2100. Although these assumptions differ materially, they do not amount to abandoning the Paris Agreement's 1.5°C objective.

The Network for Greening the Financial System groups scenarios as orderly, disorderly, too little too late and hot house world. These categories reflect different combinations of policy timing, transition risk and physical risk. They are analytical constructions, not forecasts, and their results vary with the economic models, technology costs and policy assumptions used. Model validation and sensitivity testing remain necessary.¹⁶



Within these scenarios, transition risk arises from policy, technology, demand and prices, while physical risk arises from acute events or chronic climatic change. Disorderly cases combine delayed action with abrupt adjustment. Hot-house cases give greater weight to severe physical damage. This distinction helps to keep dissimilar financial effects from being grouped under a single climate-risk label.

European supervision has moved from voluntary alignment to formal requirement. The European Banking Authority, European Insurance and Occupational Pensions Authority and European Securities and Markets Authority published Joint Guidelines on environmental, social and governance stress testing in January 2026, applying from 1 January 2027, with an initial focus on climate and environmental risks. An assessment of social factors is encouraged but not required.¹⁷ Estimated effects on output, asset values or credit losses reflect results under stated assumptions rather than predictions. The social side is less developed, with models capturing carbon prices and physical damage more readily than retraining costs, household affordability, employment losses or community impacts.

Scenario analysis is useful when its assumptions connect to a financial or strategic decision. Research published in 2026 found that companies often set up board structures, disclosures and analytical tools without integrating climate risk into enterprise risk management.¹⁸ A review of the literature suggests a practical test for businesses to apply: whether transition exposures enter risk registers, pricing, procurement, capital approval and performance assessment.

One example is the use of scenario assumptions in project appraisal and capital allocation. Internal carbon tools apply the assumptions in different ways. A carbon fee charges for emissions. A shadow price tests how an assumed carbon cost would affect an investment without necessarily charging the business, and a carbon budget caps emissions over a stated period. Their significance depends on whether they alter project selection, pricing or the allocation of capital. For businesses, usefulness depends on defined escalation points, reliable data and sufficient internal knowledge to judge between models. Without these factors, scenario analysis may improve disclosure while doing little for the financing or management of a just transition.

Technology, Autonomy and Cyber Exposure

Scenario analysis must also allow for the growing dependence of transition infrastructure on digital systems. Automation can improve network reliability and integrate variable renewable power, but it also brings operational and cyber risks. The Dubai Electricity and Water Authority offers a regional example, reporting extensive use of AI and automation in generation, networks, customer service and asset management.¹⁹ Its experience shows both the gains from digitalisation and the need for oversight as operating systems become more autonomous.

The scale of risk depends on the function performed and the consequence of failure. Demand forecasting presents less immediate danger than electricity dispatch or automated restoration. For businesses exposed to EU policy reach, AI used as a safety component of critical infrastructure may also fall within the EU's high-risk requirements for data, documentation, human oversight and effective override.



Digitalisation also widens exposure to cyberattacks. Renewable installations, battery systems and digital substations add devices, suppliers and remote connections to electricity networks. Evidence should distinguish attempted intrusions, detected vulnerabilities, confirmed incidents, ransomware events and recovery costs, since each describes a different level of disruption. A headline count of attacks says little about infrastructure resilience.

These exposures become financial losses through interrupted revenue, equipment damage, restoration costs and delayed connection. Dependence on a few software, cloud or equipment suppliers can create common points of failure across otherwise separate assets. This operational concentration constitutes a source of risk distinct from physical hazards.

An accurate assessment rests on the purpose, autonomy and possible consequences of each system. Relevant evidence includes asset ownership, data sources, safety functions, supplier dependencies and integrity due diligence, override arrangements, incident response and the privacy protections applied to customer and operational data. These factors determine whether digitalisation strengthens reliable supply or creates risks that delay a just transition and weaken public confidence.



Digital technology can improve transition infrastructure, while public policy shapes the incentives that govern investment. Carbon pricing is one such instrument. The World Bank recorded 87 direct carbon-pricing policies in 2026, covering just over 29% of world greenhouse-gas emissions and raising more than USD 107 billion (in 2025) at an average price near USD 21 per tonne of carbon dioxide equivalent.²⁰ However, policies in operation must be distinguished from those under development.

Carbon pricing reaches businesses through several channels. A facility may pay a tax or surrender allowances, while other companies face higher electricity and input costs or charges in export markets. Effective exposure may therefore differ from the published price.

The social effect depends on whether revenues support households, workers, infrastructure or reductions in other taxes, giving carbon pricing a direct tax-policy dimension for governments and reporting entities alike.

Carbon credits form a related but distinct market. Issuance increased in 2025 while average prices fell. The value of a credit depends on the activity financed, the integrity of the claimed emissions reduction and the purposes for which it may be used. Comparison between markets requires consistent prices, coverage and permitted uses and purchasers need integrity due diligence on project developers and registries.

Country platforms address a different task, connecting national plans with prepared projects and finance. Their effectiveness depends on national ownership, credible pipelines and coordination between governments and development banks.

Figure 5. Transition Policy Milestones Pending



They can bring power investment, grid development, industrial policy and social measures into one programme. A platform's headline value may nevertheless mix grants, loans, guarantees and private investment, each with different conditions and stages of commitment. Carbon pricing and country platforms are complementary: one changes incentives, the other organises projects, institutions and finance.

Policy and financing pathways depend on resilient energy systems. In the Gulf, high temperatures, water scarcity, rapid demand growth and large industrial loads place heavy demands on generation, cooling and networks. Mitigation and adaptation can be achieved through infrastructure that withstands physical hazards and operates reliably under strain.

Clean generation depends on networks, storage, cooling and water supply and physical damage or interrupted service can impair the system beyond the affected asset. Adaptation is therefore part of infrastructure design and operating continuity, not a separate environmental activity.

Battery storage set a deployment record in 2025 and is increasingly used to shift electricity between periods rather than only to provide short-term network services, with the Middle East growing strongly from a low base.²¹ Storage duration, connection rights, degradation and dispatch arrangements tend to indicate system value more than capacity alone. More than 2,500 gigawatts of generation, storage and large-load projects are reported in connection queues worldwide.²²



Recovery also needs finance after a shock. The United Nations Environment Programme Adaptation Gap Report 2025 estimates adaptation needs in low- and middle-income countries many times larger than international public flows, though comparisons vary by year, definition and coverage.²³ There is a distinction between estimated need, recorded flow and the liquidity available at each stage of recovery. For example, parametric insurance pays quickly when a defined physical threshold is crossed, but it does not compensate for full economic loss. It serves a different purpose from budget reserves, contingent credit, indemnity insurance and reconstruction finance, each of which meets a different scale or timing of loss.

These technical and financial considerations come together at project level. A completed renewable plant may lack export capacity, while a connected asset may remain exposed to heat, flood, storm or water scarcity. Connection dates, storage revenues and physical resilience therefore have an impact on project viability and system reliability. At sovereign level, the balance between reserves, contingent credit, insurance and recovery finance can determine the speed and fiscal cost of responses to disruption.

Corporate Responses

The resilience of the just energy transition also depends on whether companies turn commitments into investment and operating assets. Analysis indicates that low-carbon expenditure among the integrated oil and gas majors fell from about 19% of group capital expenditure in the 2024 financial year to about 14% in 2025, with forward guidance for 2026 to 2030 cut by 19% and at least 11 major low-carbon projects halted, cancelled or exited.²⁴

Corporate electricity purchasing gives another measure of delivery. Power purchase agreement volumes fell in 2025 for the first time in nearly a decade and became more concentrated among large technology buyers.²⁵ Developers therefore faced greater exposure to fewer counterparties and to demand tied to data-centre growth.²⁵

Meanwhile, contract structures are changing as buyers seek dependable low-carbon electricity. Firm and hybrid products combine renewable generation with storage and sometimes nuclear or other dispatchable sources. The Greenhouse Gas Protocol opened public consultation on revisions to its Scope 2 guidance in October 2025, closing in January 2026. The draft covers hourly matching and deliverability requirements that would demand closer matching of electricity in time and place, though these remain proposals until adopted.²⁶

Corporate actions also have a social side. Land access, consultation and impact-benefit agreements serve different legal purposes. The precise impact depends on contractual provisions on representation, payments, indexation, grievances, monitoring and enforceability, as well as counterparty integrity due diligence before agreements are signed.

Expenditure, power contracts and community agreements together show whether corporate commitments have commercial and social substance. Expenditure shows resources allocated. Power contracts show demand and revenue support and community agreements show how local interests are represented. Only consistent project classifications allow corporate commitments to be compared over time.

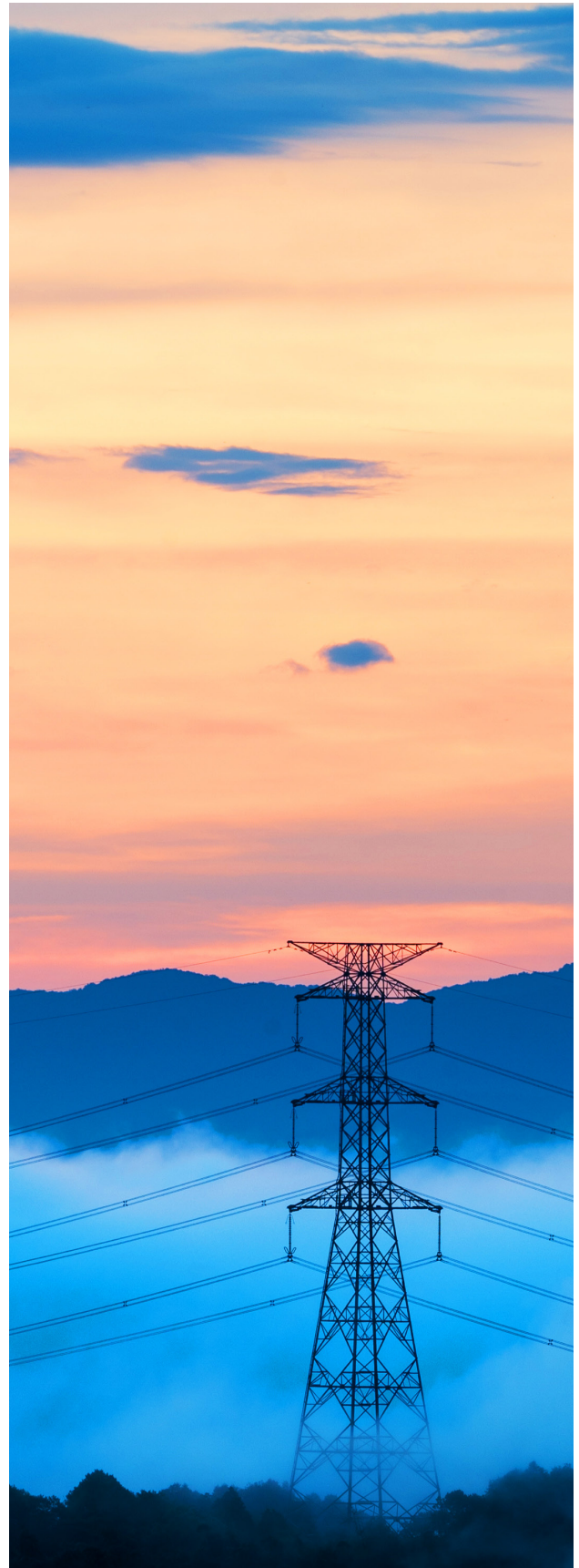
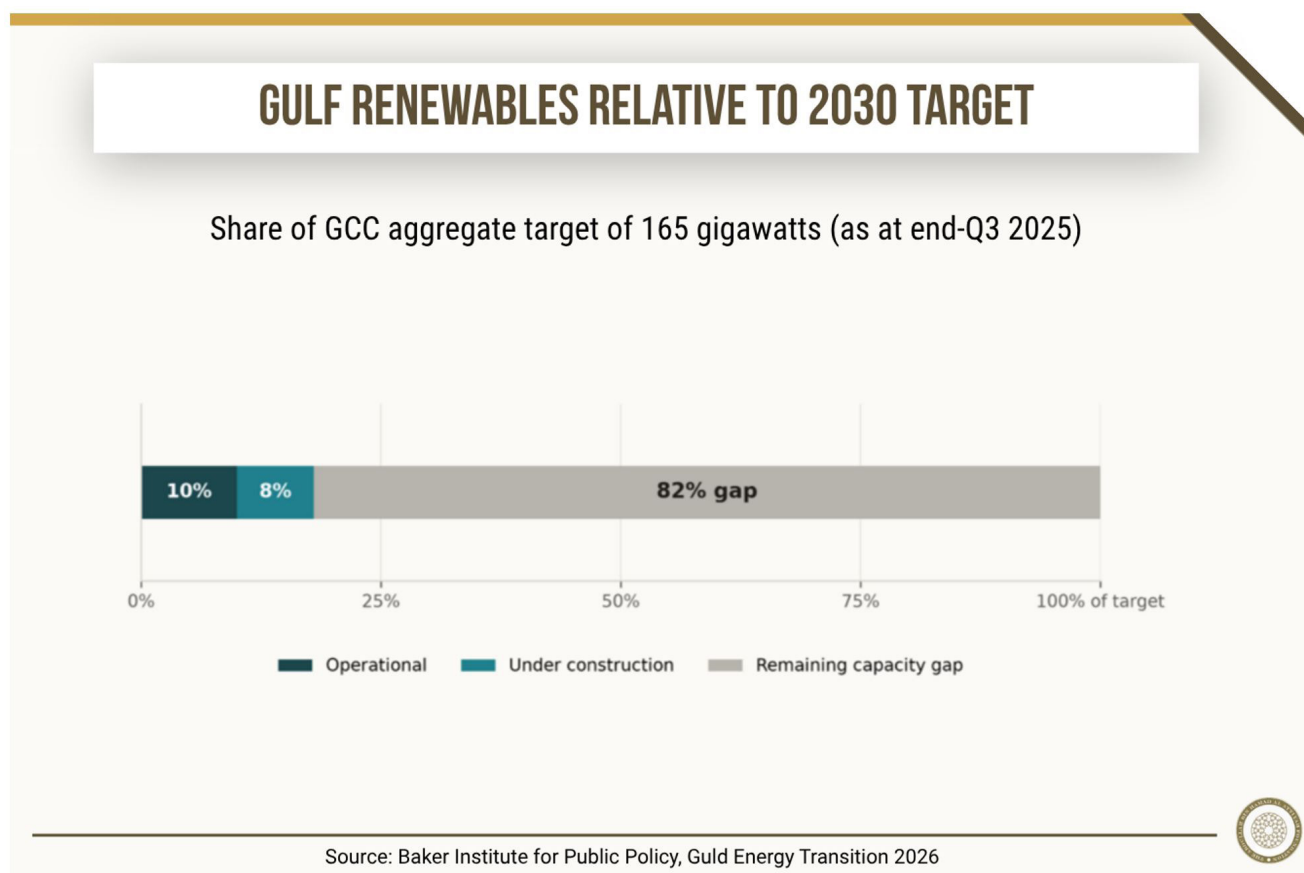


Figure 6. Gulf Delivery Against 2030 Renewable Targets



Corporate responses occur in markets that differ widely in finance, regulation, infrastructure and industrial capability and these differences shape what a just transition requires across the MENA region. Hydrocarbon exporters can draw on established infrastructure, technical expertise and strong balance sheets to diversify. Import-dependent countries may have a stronger energy-security case for renewable power but less fiscal room to absorb project and market risks.

Across the Gulf, renewable energy development has moved from announcement towards procurement and construction, though operating capacity remains well below the stated ambitions for 2030.

A Baker Institute working paper records 16,457 megawatts operating and 13,535 megawatts under construction across the GCC, about 10% and 8% respectively of roughly 165 gigawatts of announced 2030 targets. The implied delivery gap is around 135 gigawatts, with an investment requirement near USD 78 billion.²⁷

Qatar's solar programme shows the value of consistent measurement. The country recorded the strongest Energy Transition Index improvement in MENA, at 2.6 points, in 2026.² Existing plants and additions give a clear basis for recording capacity as it moves through the project cycle, from award to construction and operation. Domestic economic value needs further measures: local procurement, skilled employment, operating expenditure and technical capability.

Elsewhere in the Global South, abundant renewable resources often sit beside higher financing costs, weaker grids and limited project preparation. Africa's announced hydrogen pipeline, for example, is far larger than the capacity that has reached final investment decision. Land reservations establish an early position but do not show secured offtake or finance. Hydrogen projects can be classified by feasibility, permitting, power and water supply, offtake, financial close, construction and operation. Regional comparison needs a common reporting sequence without assuming that markets are alike.

Differences in delivery and domestic capability decide where economic value is captured. The IEA records the global market for key clean energy technologies passing USD 1.1 trillion in 2025. Market value is not the same as manufacturing output, investment or installed capacity. Rapid growth in solar and wind deployment has not produced matching revenue growth because equipment prices have fallen sharply.²⁸ As hardware becomes cheaper, more of the commercial value attaches to system integration, storage, firm capacity, grid services, software and operations and maintenance. In 2025, levelised costs rose for several generation technologies while the cost of four-hour battery storage fell to record lows.²⁹ These movements cannot be compared directly unless the technology, location, financing assumptions, storage duration and treatment of capital and operating costs are stated.

The shift matters for Gulf and other emerging markets seeking benefits beyond added generating capacity. Domestic manufacturing can capture value where market scale, input costs, technical standards and export prospects support competitive production.

In smaller markets, engineering, installation, maintenance, digital services and supply-chain management may provide a more durable base than assembly protected by a single procurement programme. Local-content figures therefore need a clear definition of domestic value added.





System constraints also create commercial openings. Storage integration, grid software, forecasting, power electronics, flexible demand, maintenance and project development can raise the amount and reliability of electricity delivered from existing assets. Their value rests on operational results rather than equipment volume. Vendor estimates of efficiency or customer savings indicate potential; realised results depend on operating conditions, the baseline chosen and the allocation of network and financing costs.

The proper economic measure is value retained over an asset's life. Construction expenditure may be large but temporary, whereas engineering, maintenance, software and system operation can support recurring income, exports and skills. The main regional opportunity is to move from supplying single technologies towards reliable energy systems and durable local capability.

Markets that combine procurement, grid capacity, skills and long-term demand are better placed to retain value as deployment expands.

Risk Monitoring

Formal frameworks are beginning to appear. The European Supervisory Authorities' Joint Guidelines on environmental, social and governance stress testing apply from 1 January 2027, at first for climate and environmental risk.¹⁷ The social side of the just energy transition therefore remains largely outside mandatory supervisory measurement. This is a key policy gap. Entities that build social indicators now will be better placed when supervisory expectations widen. Scotland's Climate Change Plan 2026-2040 offers an early model, committing to twelve statutory just transition indicators reported annually from 2027.³⁰

A just energy transition requires more than replacing high-emission energy with cleaner supply. It must keep energy reliable and affordable, create durable economic opportunity and protect workers, consumers and communities from an unequal distribution of costs. The evidence of 2026 is that the binding constraint has moved from the availability of capital to its deployment in energy transition projects. Record investment coincided with the first fall in measured transition readiness in more than a decade, while the diffusion of environment-related technologies continues to decline. Pledged finance continued to outpace allocation in the Global South, most plainly in the 43% allocation rate of South Africa's partnership and the deferral of Indonesia's Cirebon-1 closure. Nevertheless, progress can only be judged across the whole course of transition from policy commitment and project preparation to financial close, construction, operation and electricity supplied.

Financial structures shape both the pace and the fairness of this process. Commercial debt, guarantees, grants, insurance and contingent finance meet different risks and place costs on different parties, and their contribution cannot be judged by headline mobilisation ratios alone. Scenario analysis clarifies these exposures when its assumptions connect to decisions and formal supervision of environmental stress testing begins in 2027, but the social dimension remains largely unmeasured in regulated frameworks. That gap defines the residual risk: employment quality, affordability by component and community benefit are still measured less consistently than investment, emissions or capacity.

For Gulf economies, the opportunity extends beyond purchasing clean energy equipment.

Established infrastructure, financial capacity and industrial expertise provide a base for capability in system integration, storage, engineering, digital services and operations. Qatar's position as the strongest MENA improver on the Energy Transition Index offers a platform for regional benchmarks of verifiable delivery.

Credible progress requires a connected body of evidence: targets that define the assets, activities and people they cover; financial reporting that separates commitments from disbursements; project data that separates planned from operating capacity; and social reporting that shows where jobs, skills, domestic value and community benefit arise. A just energy transition will be achieved when cleaner and more resilient energy systems deliver reliable supply, sound economic value and outcomes that can be shown to be fair.



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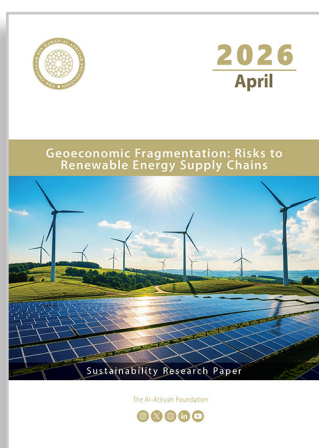
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In Search of Critical Minerals: Challenges and Opportunities

Critical minerals have become central to the global energy transition, advanced manufacturing, digital technologies and defence.



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Geeoeconomic Fragmentation: Risks to Renewable Energy Supply Chains

Geeoeconomic fragmentation – the progressive realignment of trade, investment and technology flows along strategic rather than purely economic lines – has, in recent years, moved from a scenario to a standing feature of the energy transition.



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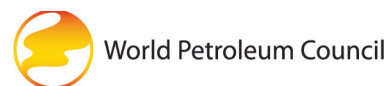
Sustainability Implications of Rising Energy Demand from Data Centres and Generative AI

Global data centre electricity demand has roughly doubled since 2020 and the International Energy Agency (IEA) has projected it will more than double again by 2030, driven primarily by generative Artificial Intelligence (AI) model-building and deployment activities.



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