The new energy dynamic: Building integrated energy systems across the Middle East

Part two of our Energy, Utilities and Resources Global Conference 2025 output series

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Executive summary

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Geopolitical risk has become a structural feature of the global energy system. Energy security now defines industrial competitiveness as economies expand data-centre capacity, electrify transport and industry, and integrate renewables. Markets and companies must design energy systems and supply chains for this new reality.

The war in Ukraine and the 2024 Iberian blackout showed that both fuel dependence and weak grid management can destabilise economies, proving that energy security now depends on system design and coordination.[1]

New vulnerabilities are emerging. Extended supply chains and export restrictions on key minerals heighten exposure for renewables and EVs, while competition for skilled labour, materials, land and capital intensifies. Sequencing and prioritisation will determine which countries move fastest.

These pressures highlight the need for energy systems and supply chains that are resilient, diversified and capable of absorbing shocks. Against this backdrop, the Middle East faces a different landscape. The region's abundant solar and wind sources offer major economic opportunities – from local manufacturing and technology exports to new green industries powered by abundant solar and wind resources. Realising this potential and building resilience requires diversification, localisation and structured cooperation. Governments can strengthen it through shared infrastructure, cross-border trade, incentives and targeted intervention.

1. https://www.theguardian.com/environment/2025/apr/29/what-caused-the-blackout-in-spain-and-portugal-and-did-renewable-energy-play-a-par

Integrated planning must align grid build-out with demand, supply-chain readiness, land availability and workforce capacity to prevent congestion, stranded assets and cost escalation. National strategies should connect through regional frameworks so regulators, operators and investors plan from shared assumptions. Such coordination is now a strategic requirement for both energy security and affordability.

The broader challenge is balancing self-reliance in areas of exposure with mutual dependence where shared assets and cooperation create collective security. Achieving this balance demands sustained coordination among governments, regulators, producers and suppliers – the actors who shape infrastructure, industrial investment and technology development. Systems that embed this balance will remain flexible under stress and competitive as the global energy landscape evolves.

This report shows how Middle East governments can build resilient, digital and interconnected grids to meet surging demand for clean energy, transport electrification and digital infrastructure. We highlight key lessons and policy priorities to move from generation to connection – ensuring that renewable power, data centres and emerging technologies can expand sustainably. By focusing on efficient capital allocation, balanced investment between transmission and distribution and stronger regional cooperation, we offer a roadmap to make the grid a strategic enabler of economic diversification, energy security and long-term competitiveness in the Middle East.

02

Powering the next phase of growth with rising demand and smarter grids

2.1 A world outpacing its grids

The next wave of growth, from AI and electrification to industrial expansion, depends on grids that are resilient, digital and interconnected. Much of today's infrastructure, however, was built for another era and is struggling to keep pace. As electricity demand accelerates and the supply mix shifts, grid constraints are emerging as the defining challenge of both industrial and climate progress. The focus is shifting from generation to connection – clean power must reach consumers quickly and at scale. According to the International Energy Agency, more than 3,000GW of renewable power projects globally are waiting in connection queues,[2] including 1,600GW of wind and solar already in advanced development. The challenge is no longer ambition but integration.

The Middle East, unlike regions burdened by ageing assets, has the opportunity to build new, integrated, digital grids from the ground up – a critical advantage as energy demand continues to surge.

> The Middle East is the third-largest contributor to global energy demand growth after China and India.

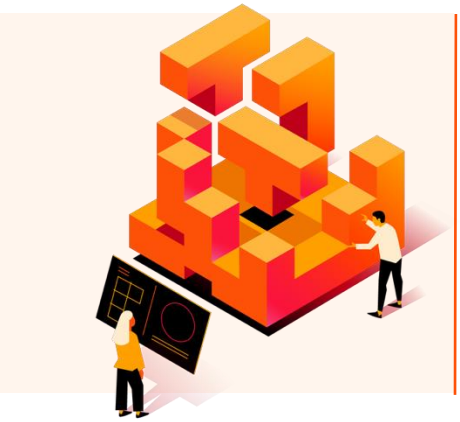
The GCC alone is set to see electricity requirements rise substantially this decade, with national clean-energy strategies pointing to the need for around 102GW of new generation capacity by 2030 – roughly twice the United Arab Emirates' (UAE) current installed generation capacity.[3]

As more renewable projects connect to the grid – often at medium voltage – both distribution and transmission networks need to evolve. Systems built for one-way power flows must now handle variable generation, two-way energy movement, and real-time balancing between supply and demand. To keep pace, tomorrow's grids must be smart, flexible, and resilient, integrating diverse sources of energy and storage while ensuring reliability and stability for homes, industries, and cities across the region.

2. https://iea.blob.core.windows.net/assets/0f028d5f-26b1-47ca-ad2a-5ca3103d070a/Electricity2025.pdf
3. https://www.energypolicy.columbia.edu/renewable-energy-development-in-the-gcc-progress-made-and-challenges-ahead/

2.2 Emerging pressures: Digital infrastructure and data centres

In the Middle East, a major new source of electricity demand is emerging from digital infrastructure, particularly data centres. Regional data-centre IT-load capacity is estimated at about 1.2GW in 2025 and is forecast to grow to around 3.3GW within five years.[4] Announced projects could push potential capacity to 4-5GW, a figure many still view as conservative.[5]



> “Data centres bring jobs, innovation, geopolitical influence but also consume significant energy and water

- a single hyperscale site can match 100,000 households. For the region, traditionally priding itself on low-cost power, grid capacity is quickly becoming a determinant of competitiveness – shaping where industries, investors and innovators choose to build the future. As AI workloads expand, energy and digital policy are increasingly converging, requiring joint planning between utilities and technology regulators. GCC utilities are already moving in this direction. DEWA’s digital substation programme and Saudi Electricity Company’s smart metering rollout show how energy and data networks can grow together to meet rising demand.[6, 7]

As this surge in digital infrastructure accelerates, it places new demands on the grid that cannot be met through traditional upgrades alone, requiring a shift toward smarter, digitally enabled systems that can manage complexity and volatility at scale.

4. https://www.pwc.com/m1/en/publications/middle-east-economy-watch/may-2025/data-and-projections-may-2025.html
5. https://www.arizton.com/market-reports/middle-east-data-centers
6. https://www.zawya.com/en/projects/utilities/dewa-wins-award-for-digital-substations-jnibovk3
7. https://alfanarprojects.com/en-us/projects/smart-meters-project-smp

2.3 Building a smart, digitally enabled grid

As data centres and AI workloads drive new demand, digitalisation becomes the foundation of grid modernisation. Smart grids use sensors, automation and data analytics to balance supply and demand in real time, while digital twins simulate networks, optimise connections and accelerate project approvals. But these technologies can only deliver their full value if the regulatory framework evolves in parallel.

As grids become more digital, regulation must keep pace. The energy transition will be delivered or delayed in the wires, and the rules governing them will determine how fast systems can adapt. Expanding networks without clear prioritisation risks wasted capital, ineffective use of land and slow progress. Regulators therefore need to focus investment on the areas that matter most, such as congestion hotspots, industrial clusters and renewable zones where delays are already emerging.

Digital substations, automation, dynamic line ratings and advanced metering infrastructure should be treated as essential system upgrades because they unlock latent capacity and allow operators to use existing assets more efficiently before turning to costly new build. Clear regulatory expectations on data, interoperability and performance will help ensure that these technologies strengthen reliability rather than add complexity. By shifting regulation towards system value and away from asset volume, governments can accelerate integration, reduce delays and improve long-term resilience.

These regulatory shifts must also be paired with advances in forecasting, automation and cyber resilience as grids become more connected and exposed to new risks. AI-enabled forecasting improves renewable integration by predicting weather-driven fluctuations. Automated controls enhance reliability by rerouting power or isolating faults instantly. Yet as grids become more connected, they also become more exposed to vulnerabilities.

Cyberattacks on the Middle East's energy sector rose sharply in 2024[8] and must be treated as a critical part of energy security, supported by regional standards, monitoring centres and joint training initiative.

8. https://www.cpx.net/insights/blogs/uae-cybercrime-statistics

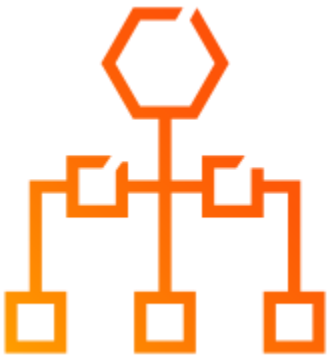
03

The need for effective allocation of capital

3.1 Investing for resilient growth

Meeting rising demand will require major investment and disciplined allocation. Global investment in transmission and distribution must roughly double by 2030, increasing from around US$300bn to US$600bn a year, for the world to stay on track for net zero goals.[9] In the GCC, annual investment in power infrastructure already totals tens of billions of dollars, and how this capital is deployed will determine both reliability and competitiveness.

Expanding networks quickly is now vital for competitiveness, but speed without coordination can lead to stranded assets, delays and financial strain. As governments worldwide develop grid and clean-energy infrastructure simultaneously, supply chains, schedules and labour are already under pressure. The key is to allocate capital where it delivers the greatest system value, directing materials and talent to the highest-impact projects.



System planning must treat generation, grids and demand as an integrated whole.

Aligning major investments with clear demand anchors — such as industrial zones and data-centre clusters — avoids underused infrastructure and ensures resources are deployed efficiently.

Digital modelling tools can reveal chokepoints and maximise the use of existing assets. Investment should focus on the highest-impact areas: strengthening transmission, reinforcing distribution and creating dedicated industrial or data-centre zones that can attract demand and unlock new financing models.

9. https://www.europarl.europa.eu/RegData/etudes/BRIE/2025/772854/EPRS_BRI%282025%29772854_EN.pdf

3.2 Balancing transmission and distribution

For decades, energy strategy focused on long-distance transmission lines. Today as renewables proliferate, and as transport and industry electrify, much of the new supply and demand are now appearing at distribution level – closer to consumers.

Distribution networks now sit at the centre of decarbonisation, carrying both rising demand and new forms of decentralised generation. Ensuring capital is balanced across transmission, distribution and regional interconnection is essential for clean power to reach consumers efficiently.

Smart meters, flexible tariffs, and local control centres can deliver the same system value as new transmission lines, while grid-hardening and cyber-resilience programmes protect against risk. There is no transition without transmission – and the transition cannot succeed without a resilient, modernised distribution layer.

3.3 Investing in resilient infrastructure

Effective investment depends not only on the amount of capital but on the resilience of the systems it builds. Resilient grids ensure stable power delivery consistently to every industrial cluster and urban area and this opens new economic opportunities for nations. Building resilience also means strengthening operational stability. As renewable generation accelerates, maintaining system inertia, strong dispatch protocols and coordinated operations is essential to avoid disruptions like the blackout in Spain.[10] Storage technologies such as batteries and pumped hydro provide the flexibility and inertia required to keep grids stable, while gas will continue to evolve from baseload to backup.

Technical discipline must continue to guide the transition – reliability and inertia cannot be sacrificed to meet short-term capacity or policy goals. Regional examples already reflect this mindset: TAQA and EWEC's US$9.8bn investment in Abu Dhabi,[11] Saudi interconnections with Egypt and Iraq, along with Qatar's predictive-maintenance systems all demonstrate the region's commitment to resilient infrastructure.

10. https://www.theguardian.com/environment/2025/apr/29/what-caused-the-blackout-in-spain-and-portugal-and-did-renewable-energy-play-a-part
11. https://taqatransmission.com/node/121

3.4 Regional interconnection and cooperation

Scaling resilient grids will require new models of collaboration and financing. Partnerships between utilities, investors, and technology firms – supported by export credit agencies – can help mobilise capital for grid infrastructure and accelerate deployment while sharing risk. Blended finance, regional procurement and joint-venture models are beginning to appear as utilities look to crowd in private participation.

Regional interconnection remains a powerful enabler of resilience and efficiency. The challenge now is how to finance, build and operate these links sustainably through coordinated planning and shared standards. Guarantees and risk-sharing mechanisms can further unlock private capital while protecting public budgets. Sovereign wealth funds and development banks can act as system integrators – providing first-loss guarantees, aligning project timelines and convening global suppliers to keep national energy programmes on track. Clear contracts, transparent procurement and predictable regulation will be essential to sustain investor confidence and reduce financing costs.

04

What powers the transition: Supply chains and governance

4.1 Cables and critical minerals

Every clean-energy project depends on cables, transformers and critical materials, where shortages and long lead times are delaying projects and raising costs

Meeting (global) net-zero pathways will require around US$21.4trn of grid investment by 2050[12]

and roughly 80 million kilometres of additional transmission lines by 2040 – more than double today's network length.[13] Expanding regional manufacturing of transformers, switchgear, and cabling can shorten lead times, create skilled jobs, and strengthen supply resilience. With copper and rare-metal production concentrated in a few countries, shared procurement, early financing, and circular-economy initiatives will be vital to secure materials, stabilise delivery, and reduce import dependence.

In the region, Saudi Arabia, the UAE and Qatar are expanding into clean-energy value chains, adding upstream capacity, advancing downstream processing, reforming mining laws, and investing in digital innovation to build secure, efficient and low-carbon supply networks. Recent projects in copper, aluminium recycling, and battery materials highlight the region's ambition to become a key global player in critical minerals and clean-technology manufacturing.[14]

12. https://about.bnef.com/insights/finance/global-net-zero-will-require-21-trillion-investment-in-power-grids
13. https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions/executive-summary
14. https://www.pwc.com/m1/en/publications/2025/docs/us300bn-middle-east-2025.pdf

4.2 Regulation: The invisible architecture of transition

Regulation is the invisible architecture of the energy transition. Stable, predictable frameworks turn ambition into implementation by giving investors confidence that returns will match risk. Policy should align incentives with outcomes such as reliability, flexibility and efficiency, rather than focusing solely on capital expenditure.

Tariff structures that recognise system value – for example rewarding demand-side flexibility or local generation – can encourage more efficient behaviour from both utilities and consumers.

Subsidy reform is equally important. Gradually phasing out universal energy subsidies while protecting vulnerable users will free fiscal space for grid modernisation and innovation. Clear, consistent rules will also underpin the systems thinking required to connect energy, industry and digital policy.

05

Building integrated energy systems of tomorrow

5.1 Connecting infrastructure for coordinated growth

The clean-energy transition is as much a systems challenge as an engineering one. Building transmission corridors around industrial zones and AI hubs can reduce delays and create anchor areas for investment.

Power, water, transport and digital infrastructure are increasingly interdependent. System thinking connects these sectors to achieve shared outcomes: reliable supply, industrial growth and reduced emissions. Integrated planning and procurement across ministries and utilities can prevent stranded assets and ensure that giga-projects, renewables and industrial zones complement rather than compete with one another.

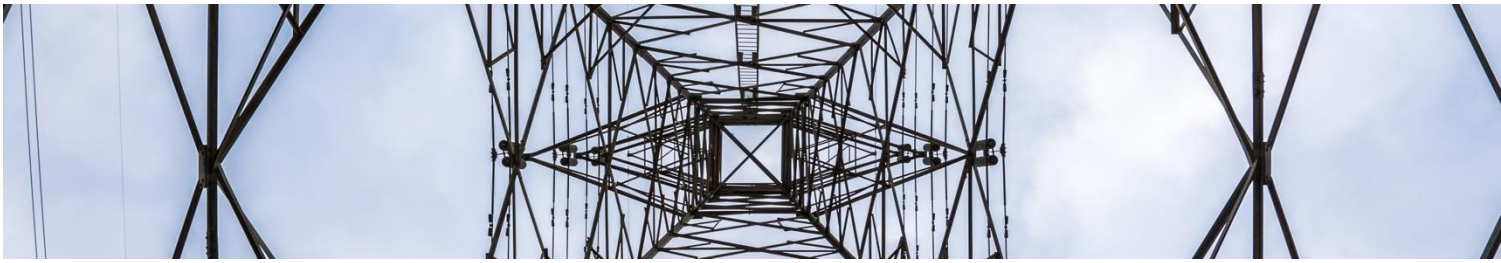
This interconnectedness is becoming more visible across the region where giga projects and emerging AI and data-centre hubs in the GCC all illustrate how energy, water, digital and mobility systems must be planned together. These developments require aligned grid capacity, water desalination, cooling loads, transport access and digital backbones. Without integrated design, a bottleneck in any one system - whether land availability, forecasting accuracy, or connection queues – can delay entire clusters. Aligning these systems from the outset is therefore essential to delivering these national priorities on time and at scale.

5.2 Policy priorities for the next decade

To strengthen the policy foundations of integrated energy systems, governments across the Middle East should:

01	**Accelerate permitting and planning** with clear timelines and cross-value-chain coordination.
02	**Balance grid investment** across transmission, distribution and interconnection.
03	**Align regulation with system outcomes** driving flexibility, reliability and efficient use of assets.
04	**Procure and finance clusters** to manage land constraints and anchor demand.
05	**Understand systemic risks** by identifying critical demand centres and their infrastructure needs.
06	**Modernise standards and procurement** to speed delivery and reduce costs.
07	**Build resilience** through stronger supply chains, cybersecurity and workforce capability.
08	**Attract private capital** via predictable regulation, transparent procurement and regional cooperation.

Through coordinated policy, investment and regional cooperation, the Middle East can shape an integrated energy system that powers sustainable growth and strengthens global energy security.



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