Morgan Stanley | RESEARCH

GLOBAL INSIGHT

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Future of Energy

Power: Changing Face with AI

The world of electricity is transforming at an unprecedented pace. AI's power appetite is undeniable – but next US$350bn in value creation will come from those pivoting to help navigate accelerating electricity market tightness. Reliable power is premiumising, driving renewed investment in natural gas, energy storage and nuclear, and potentially doubling equities' earnings growth.

Tech Diffusion

A Morgan Stanley Research Key Theme of 2025

Future of Energy

A Morgan Stanley Research Key Theme of 2025

Global power sector investment reached a new high of US$1.5 trillion in 2024, and consumer power prices rose ~15%. The age of electrification, amplified by AI, is reshaping power markets, and, as in the 1990s, power prices are set to rise further. We estimate ~US$3 trillion investments in datacenters by 2028, with power consumption growth of 126GW from 2025-28, i.e. nearly as large as Canada's total annual consumption. Between April 2024 and now, our projected 2025-27 data center power demand has increased 56%. This is driven by the non-linear rate of AI improvement and increased demand for compute.

We raise our power consumption estimates for the third time in two years, now 15% above IEA estimates. Reserve margins are set to decline globally, with the US and Asia facing the sharpest squeeze as hyperscaler spillover adds pressure. US power markets will get much tighter than we estimated before, and account for half of datacenter power consumption by 2030e. We now forecast Asia to get 15% of US hyperscaler spillover demand, which, when combined by China hyperscaler needs, will see power markets in Malaysia, Japan, Thailand and Singapore become a lot tighter.

We estimate power spreads for generation companies to rise 15% by 2030, implying 5-15% upgrades to street earnings estimates for our Overweight-rated stocks, and US$350bn in value creation across the power supply chain. ***Key stock picks: EQT, Vistra, NextEra, Reliance, Adani Power, JSW Energy, RWE, CATL, Tenaga, Keppel, Hokkiado Electric. See*** **Exhibit 13**

A Trillion Units of Strong Growth: The world of power is changing in the data era, now consuming a trillion more units of power every year, i.e. twice the pace of growth in the last decade. This hyper growth in consumption will redefine the power story in four areas as spare capacity reduces by a fifth around the world for rest of the decade.

1) **Electric Grid underinvestment** - only half that of power generation in recent decades - has created major bottlenecks. This is fueling new investments in electric grids globally and a renewed dependence on natural gas and energy storage to stabilize renewables. Record gas investments in 2024 and the coming globalization of gas from 2026 will accelerate this shift. With natural gas poised to supply a fifth of new power demand (ex-China), we expect energy storage adoption to inflect and nuclear power to get more investment - overall lifting marginal power costs by 10-30%, thus anchoring higher power prices.

2) **Premiumisation of reliable electricity,** with consumers ready to pay up to 2x more over current prices, could **double earnings growth for generators** by 2027e. More merchant power and captive/behind-the-meter is in the works than ever before. We believe about ~10% of new power needs will be **captive/behind-the-meter** and merchant supply will account for nearly quarter of global power units consumed by 2030e, i.e. double that in 2024. This would structurally raise ROE for power generators by 300bps.

3) **Tiered power pricing,** to address affordability concerns, will go global and support energy storage investments even more. Malaysia charges 15% higher prices for DCs, effectively bearing most new grid investments, and multiple US states are exploring this option.

4) Renewable cost deflation has reversed after two decades. China's anti-involution drive in solar supply chain should further raise costs as polysilicon capacity is cut by a third, raising solar module prices by 15% by 2027e. This adds to the upside risks in power prices and spark spreads.

Who Re-rates Next? How to Position: Gas, nuclear, energy storage and fuel cell technology supply chains in Asia and US are set to re-rate next as they benefit from better pricing power, new opportunities to grow and lower fuel costs. Grid operators in most parts the world will benefit from increased investments and wider spreads over cost of capital. Pure solar/wind producers may struggle with higher cost inflation in the solar supply chain in Asia but less so in US/Europe (Exhibit 14).

Contributors


MORGAN STANLEY ASIA (SINGAPORE) PTE.+
Mayank Maheshwari
Equity Analyst
+65 6834-6719
Mayank.Maheshwari@morganstanley.com


MORGAN STANLEY ASIA (SINGAPORE) PTE.+
Ryan M Heng
Research Associate
+65 6834-6465
Ryan.Heng@morganstanley.com


MORGAN STANLEY & CO. LLC
Stephen C Byrd
Equity Strategist
+1 212 761-3865
Stephen.Byrd@morganstanley.com


MORGAN STANLEY & CO. LLC
David Arcaro, CFA
Equity Analyst
+1 212 761-1817
David.Arcaro@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Robert Pulleyn
Equity Analyst and Commodity Strategist
+44 20 7425-4388
Robert.Pulleyn@morganstanley.com


MORGAN STANLEY EUROPE S.E., PARIS BRANCH+
Arthur Sitbon, CFA
Equity Analyst
+33 1 42 90 71-03
Arthur.Sitbon@morganstanley.com


MORGAN STANLEY & CO. LLC
Devin McDermott
Equity Analyst and Commodities Strategist
+1 212 761-1125
Devin.McDermott@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Martijn Rats, CFA
Equity Analyst and Commodities Strategist
+44 20 7425-6618
Martijn.Rats@morganstanley.com


MORGAN STANLEY ASIA LIMITED+
Eva Hou
Equity Analyst
+852 2848-6964
Eva.Hou@morganstanley.com


MORGAN STANLEY MUFG SECURITIES CO., LTD.+
Reiji Ogino
Equity Analyst
+81 3 6836-8930
Reiji.Ogino@morganstanleymufg.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Ricardo Rezende, CFA
Equity Analyst
+44 20 7677-9886
Ricardo.Rezende@morganstanley.com


MORGAN STANLEY C.T.V.M. S.A.+
Fernando P Amaral
Equity Analyst
+55 11 3048-6121
Fernando.Amaral@morganstanley.com


MORGAN STANLEY AUSTRALIA LIMITED+
Rob Koh
Equity Analyst
+61 3 9256-8932
Rob.Koh@morganstanley.com


MORGAN STANLEY INDIA COMPANY PRIVATE LIMITED+
Girish Achhipalia
Equity Analyst
+91 22 6118-1124
Girish.Achhipalia@morganstanley.com


MORGAN STANLEY ASIA LIMITED+
Jack Lu
Equity Analyst
+852 2848-5044
Jack.Lu@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Max R Yates
Equity Analyst
+44 20 7425-1917
Max.Yates@morganstanley.com


MORGAN STANLEY ASIA LIMITED+
Tim Chan, CFA
Equity Strategist
+852 3963-4568
Tim.Chan@morganstanley.com


MORGAN STANLEY & CO. LLC
Amanda Huang
Research Associate
+1 212 761-4197
Amanda.Huang@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Giuseppe Villari
Research Associate
+44 20 7425-9341
Giuseppe.Villari@morganstanley.com


MORGAN STANLEY C.T.V.M. S.A.+
Bruno Oyamata
Research Associate
+55 11 3048-6112
Bruno.Oyamata@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Marina Fuentes Juan
Research Associate
+44 20 7425-2268
Marina.Fuentes.Juan@morganstanley.com


MORGAN STANLEY AUSTRALIA LIMITED+
Samantha R Edie
Equity Analyst
+61 2 9770-1671
Samantha.Edie@morganstanley.com


MORGAN STANLEY INDIA COMPANY PRIVATE LIMITED+
Amit Bhinde
Equity Analyst
+91 22 6118-1031
Amit.Bhinde@morganstanley.com

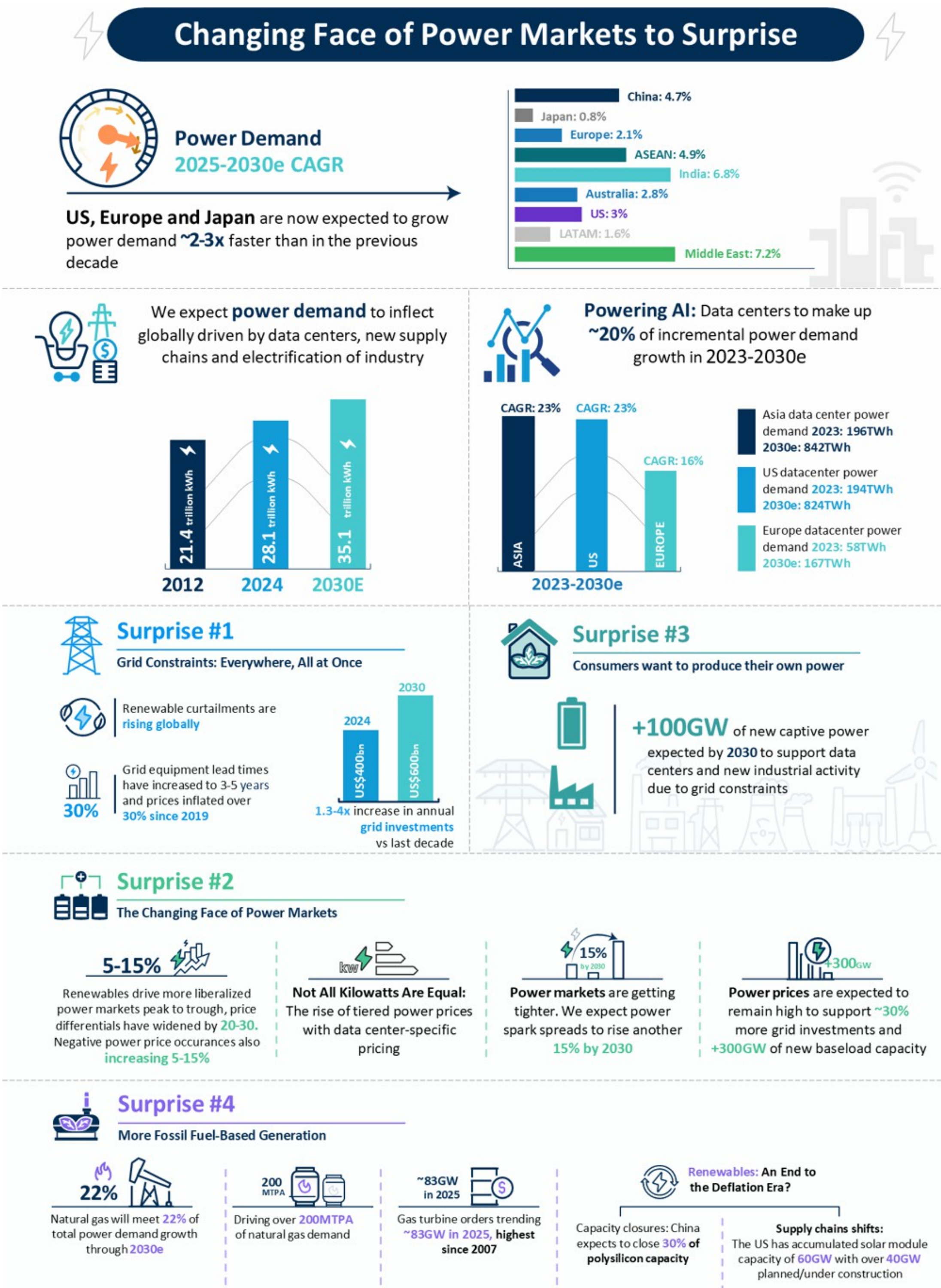

MORGAN STANLEY ASIA LIMITED+
Ehsernta Fu
Equity Strategist
+852 3963-3711
Ehsernta.Fu@morganstanley.com


MORGAN STANLEY & CO. INTERNATIONAL PLC+
Claire Liu
Research Associate
+44 20 7425-7649
Claire.K.Liu@morganstanley.com

Contents

Changing Face of Power Markets: A Snapshot

Exhibit 1: Changing Face of Power Markets: A Snapshot



Source: Morgan Stanley Research

The Trillion Units: Changing Face of Power with AI

INDUSTRY VIEW

ASEAN Utilities and Infrastructure | Asia Pacific
In-Line

Australia Utilities & Infrastructure | Asia Pacific
In-Line

Brazil Electric Utilities | Latin America
No Rating

China Utilities | Asia Pacific
Attractive

Diversified Utilities / IPPs|North America
Attractive

EEMEA - Utilities | Europe
No Rating

Energy & Utilities | Japan
In-Line

Hong Kong Utilities | Asia Pacific
In-Line

India Utilities | Asia Pacific
In-Line

Latin America Utilities | Latin America
No Rating

Regulated Utilities | North America
In-Line

Utilities | Europe
In-Line

China Energy & Chemicals | Asia Pacific
In-Line

Global power consumption has surged at the fastest pace in over a decade in the past two years, and our models signal accelerated tightness ahead - annual demand is set to rise by over one trillion units a year through 2030, with AI-driven data centers contributing roughly 20% of that growth. As outlined in our reports, **Global Clean Power: At a Tipping Point** and **Powering AI: The Inferences**, investors and policymakers are now recognizing this acceleration. **Yet, the deeper implications for pricing dynamics, generation mix, and power infrastructure remain largely underappreciated.** See Exhibit 2

We see a multi-decade shift ahead that will change the face of power markets bringing multiple areas of surprise, such as more collaboration between fossil and non-fossil fuels, tiered pricing for consumers, more spot market and behind-the-meter power sales, and, most importantly, higher-for-longer power spreads. While regional dynamics vary, the tightening of power markets is reshaping the entire value chain - from generation and transmission to batteries, equipment, and renewables. This new energy narrative is here to stay. We see this as a US$350bn opportunity (Exhibit 14), with global consumption entering a new, elevated norm and generator earnings growth is set to double through 2027. Natural gas and nuclear are best placed to meet shifting load pattens, especially as renewable output becomes more variable, China's anti-involution disrupts long-term deflation trends in renewable equipment costs, especially solar, (See Clean Power: Deflation Path Supercharges Adoption) and the nature of power supply agreements becomes more market-linked as more consumers produce their own power. The diffusion in energy and power markets also continues. While each region has its nuances, we believe the trend of tightening power markets changing the narrative for the sector across generation, transmission & distribution, batteries, equipment supply chain and renewables is here to stay.

Power Prices: The Case for Spark Spreads to Increase: In most traded power markets, prices are in backwardation, i.e. current prices are higher than forward prices, and reflect the backwardation in global natural gas markets, under appreciating the tightening of power markets ahead. We estimate that spark spreads, i.e. the power price over the cost of fuel, will rise by an average 5% by 2027 (Exhibit 6), as our forecast for power demand growth of six trillion units of power by 2030 is met increasingly by costlier natural gas, nuclear, batteries, and renewable capital costs. In the US, we estimate every GW of load increase raises wholesale power prices by 8%, while on average in Asia we see spark spreads rising 15% in 2025-27e.

How Are We Positioned? Power supply chain equities are undergoing a structural re-rating - up 30-50% over the past two years - and we expect this momentum to continue through the decade across multiple markets (Exhibit 14). We see hybrid generators, gas utilities, and nuclear players outperforming pure renewables, while regulated grid companies benefit from rising demand and capex upside.

Global power demand is surging - rising from 29T units in 2024 to 35T by 2030e, a 3.8% CAGR and the fastest growth in two decades, and 1.5x more than the last decade (Exhibit 23). We expect AI/data centers alone to drive 20% of this increase, with 100GW of US data center capacity - and similar builds in Asia and the Middle East - coming online by 2030e. **This shift is accelerating energy market diffusion and reshaping power structures:**

1. Fossil-fuel-based generation is taking share back from renewables;
2. Renewable costs and returns are set to deflate, as equipment costs rise, while at the same time coal/natural gas prices also deflate, and grid constraints become more acute;
3. Nuclear energy sees a renaissance after 50 years; and
4. AI is shifting demand and daily load patterns, as base loads become stickier over the day.

Policy responses vary, but common themes include extended coal lifespans, rising gas adoption, and grid investment. Natural gas and renewables are set to increasingly compete with coal, especially as gas markets loosen. In grid-constrained regions, batteries will gain traction - particularly in the US and Europe, where carbon pricing adds pressure to gas economics.

In 2024, global investment in coal and gas-fired generation hit its highest level since 2017. Over 40GW of new capacity has been announced in the past two years, with at least 10GW of planned retirements now extended. We forecast a 1.3 trillion unit increase in natural gas-based power generation by 2030 (~20% of incremental demand) despite aging infrastructure in India and Europe. Supply chain constraints on gas turbine equipment is extending co-generation lifespans. We estimate ~30% of AI-driven power demand can be met by natural gas. See: **Global Thematics and Sustainability: The Nuclear Renaissance Is Here - What's Next?** and **Future of Energy: Natural Gas: Fueling The Decade, Powered by AI**.

The Power Grid: We believe access to power grids is becoming ever-more important, and remain key bottlenecks to providing adequate supply as investments lag generation by more than half. We believe consumers, especially those inelastic to power pricing like DCs and commercial consumers, will increasingly pay higher power prices in most markets while also accessing the grid. As countries also look to stabilise their grids, potentially introducing capacity payments for technologies like batteries to allow this, we think there will be an increase in cost to service consumers, raising power costs.

We see pricing power for grid operators inflating multiples. While most grids earn a regulated return, increasing capex needs will add to power tariffs (currently grid tariff is ~30% of power cost on average globally) and we expect grid tariffs to rise in-line with our estimated 30-40% rise in global grid capex through 2030. The shift in power pricing mechanisms, grid constraints and higher power prices are making batteries viable alternatives to reduce renewable deficits. Hence, we see significant inflection in global energy storage demand in future.

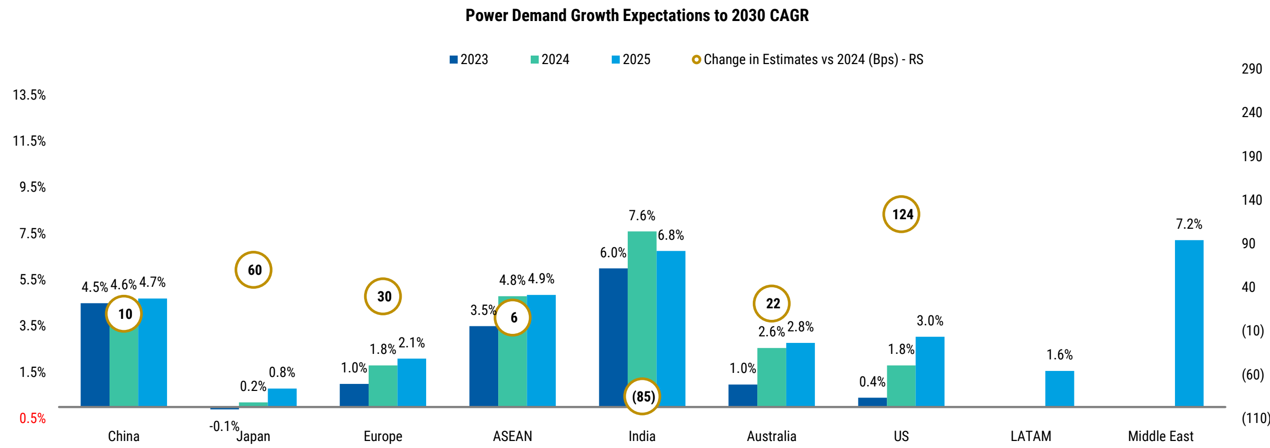
Asia vs Europe vs US - The Difference in Approach: While we highlighted the similarities in various continents on power price structure shifting, each has its own ways of addressing power shortages depending upon affordability, level of market tightness, energy transition goals and quality of the grid. We outline these in numbers in Exhibit 12.. These differences in approach also bring risks to our thesis and one common overhang is concerns around policy action related to affordability of power as power markets get tighter. While tiered power prices help address it, there could be multiple de-rating in equities until policies finalise. Another key risk to the thesis is impact of carbon taxes on profitability of generation and gas pipeline companies as the policies around carbon tax remain fluid.

Exhibit 2: Changing Face of Power Market: Key Surprises Ahead

Country	Surprise #1 : Grid Constraints are Everywhere	Surprise #2: Power Markets are Changing	Surprise #3: Consumers Want to Produce their Own Power	Surprise #4: Fossil Compliments Renewables
US	New grid connections could take more than five years in some regions.	Regulators are exploring more differentiated pricing for high consumption users. Higher prices could lead to new market structures in some states.	Datacenters are adding on-site gas and battery storage to secure multi-year, high-availability power as demand from AI surges.	Regulators are approving new gas power plants to increase baseload availability.
Europe	Grid connections are a bottleneck – utilities have started looking into how to monetise these (e.g. RWE & Iberdrola).	Strong emphasis on the need to increase share of contracted volumes to offer stable costs (PPAs typically).	Limited number of large on-site deals observed so far. Good traction for distributed solar installations in some countries.	New gas plants envisaged in a few countries (e.g. Germany). More emphasis on visible remuneration of gas plants. Life extension of nuclear considered in some countries.
China	Higher curtailment of renewable power	Regulators are moving to market-based power pricing mechanisms to manage demand load	Industrial captive demand drives development of new power plants	Regulators are approving new gas and coal power plants to increase baseload availability
India	Higher curtailment of renewable power	Increased spot power trading volumes	Industrial captive demand drives development of new power plants	Regulators are approving new coal power plants to increase baseload availability
Japan		Increased spot power trading volumes		Regulators are approving new gas power plants to increase baseload availability
Australia	Australia is prioritising Renewable Energy Zones (REZs) to connect the next stage of utility-scale renewables. Australia's National Energy Market sees regular variable renewable energy curtailment.	Australia spot markets are becoming increasingly weather based, which increases volatility. The Australian Government is proposing a 3-hour free Solar Sharer tariff for residential customers.	Limited evidence of hyperscaler direct power procurement in Australia. Baseload capacity might become available if aluminium smelters close.	Many Australia utilities are exploring additional gas-fired generation, however high domestic gas prices may limit this application.
ASEAN	Increased grid investments in Malaysia, Thailand, Singapore and Philippines to support higher demand and more distributed generation	Regulators are exploring more differentiated pricing for high-consumption users	Industrial captive demand drives development of new power plants, limited hyperscaler direct consumption	Regulators are approving new gas and coal power plants to increase baseload availability

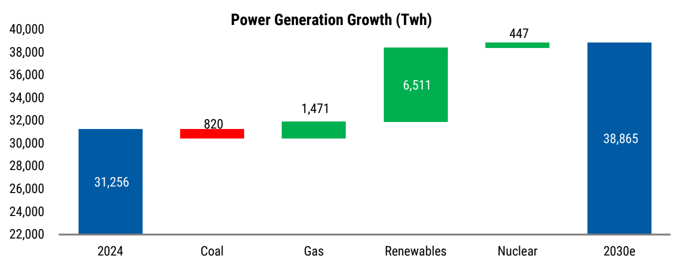
Source: Morgan Stanley Research estimates

Exhibit 3: Global Power consumption growth by country: Upward revisions in consumption estimates continue



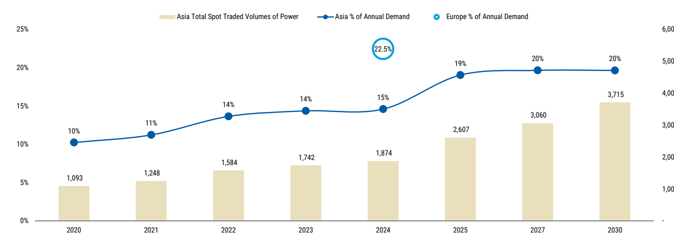
Source: Morgan Stanley Research estimates

Exhibit 4: We estimate incremental power capacity to be met with gas and renewables



Source: Company data, Morgan Stanley Research estimates

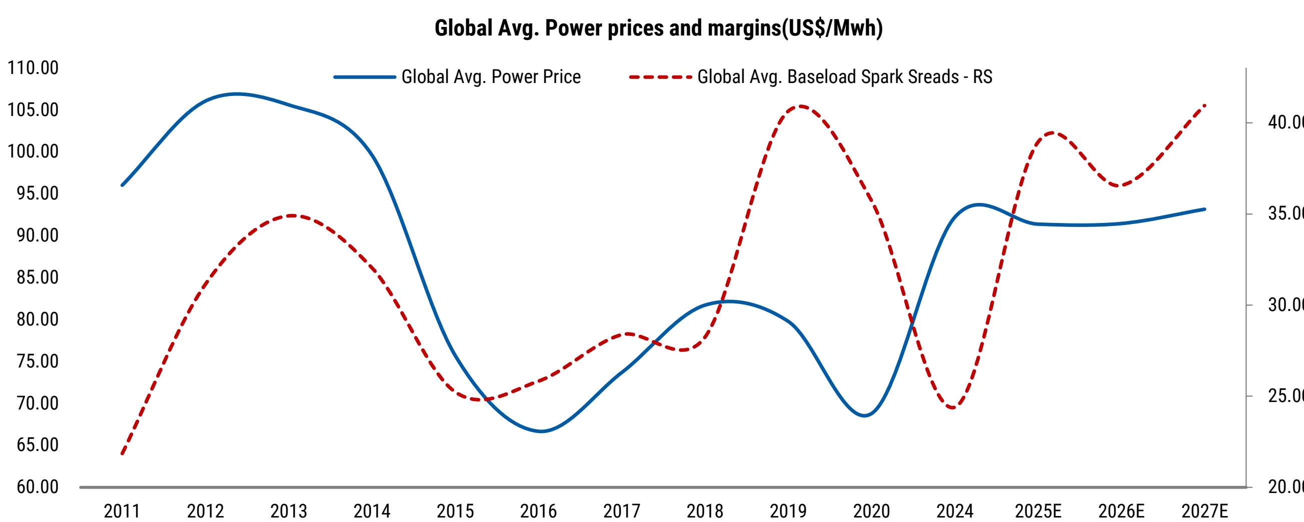
Exhibit 5: Spot power volumes traded have been increasing, making the case for more gas-based power generation



Source: Company data, Morgan Stanley Research

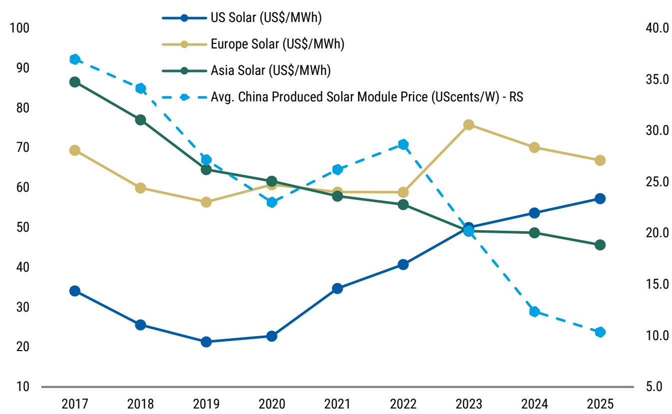
Exhibit 6:

We expect power prices to remain above mid-cycle levels despite lower fuel costs as power markets remain tight globally



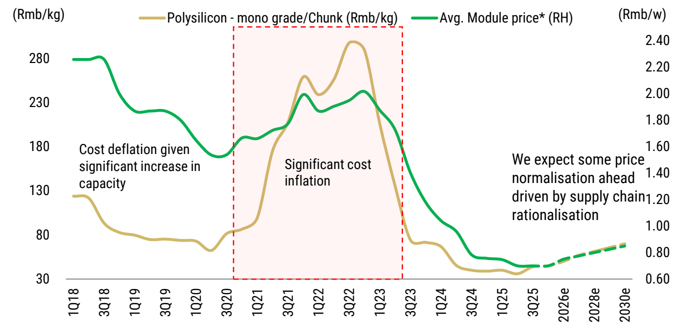
Source: Company data, Bloomberg, IEX, EMA Singapore, EPPO Thailand, e = Morgan Stanley Research estimates

Exhibit 7: Solar PPA auction prices have not had the same pace of decline as equipment costs



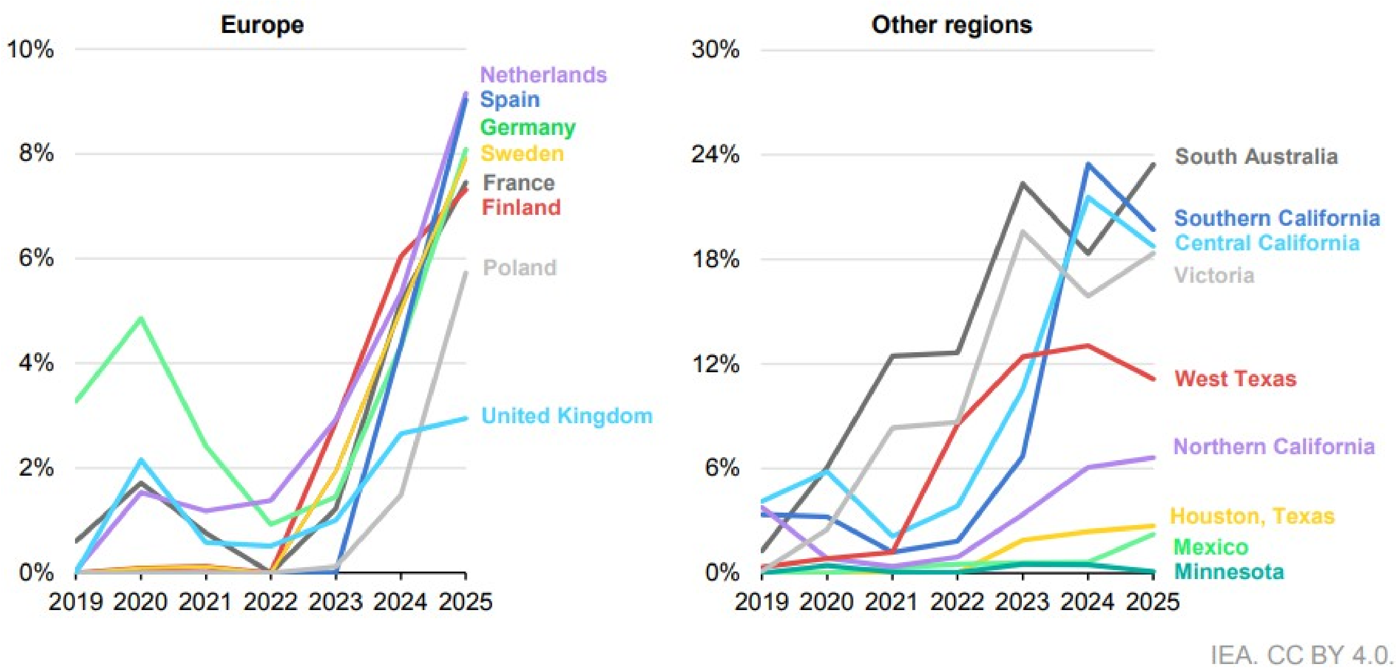
Source: PVinfo, Morgan Stanley Research

Exhibit 8: We have seen module prices reverse their 2021-23 inflation and de-rated below pre-Covid levels, however we now expect supply chain rationalisation to drive upside to prices



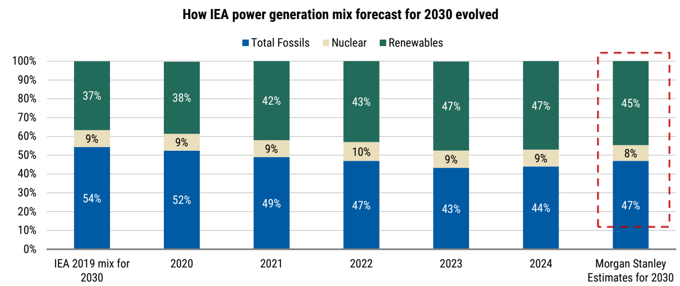
Note: For 2020-21, Avg. module price = Average PERC 440-450w and PERC 180/210mm. For 2022-2030e, Avg. Module price = Average PERC 180/210mm, TOPCon 182mm and HJT Bifacial 210mmSource: Company data, BNEF, PVinfo, e = Morgan Stanley Research estimates

Exhibit 9:
Fraction of negative hourly wholesale electricity prices has been increasing globally



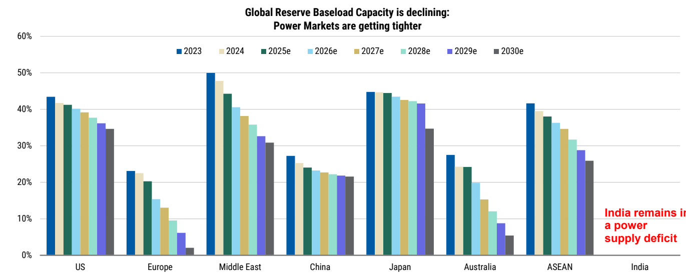
Source: IEA, Real-Time Electricity Tracker

Exhibit 10: How our estimates compare with IEA generation mix forecasts for 2030e



Source: IEA, Morgan Stanley Research estimates

Exhibit 11: Reserve baseload capacity is declining in all regions, highlighting how power markets will get even tighter



Source: Company data, Statistical Review of World Energy, e = Morgan Stanley Research estimates

Exhibit 12:

Global Power Trends Similarities and Nuances

Global Power Trends			
Regional Differences			
	Asia	**US**	**Europe**
Consumption growth 2024-2030e	4.6%	2.7%	2%
AI/ Data centers as a % of demand growth	13%	75%	36%
All-In Power Price (US$/MWh)	80-200	~100	160-170
Baseload Power Generation Price (US$/MWh)	55-95	85	50-120
Solar LCOE (US$/MWh)	35	58	45
Avg. Baseload Spark Spreads (US$/MWh)	35	35	25
Gas Based Generation (% of incremental generation)	15%	30%	Decline
Captive/Behind the meter Power Generation Growth	>100GW; Re-shoring, Datacenters and Energy Consumption Growth	Gas turbines and Energy Storage drive by new data centers	NA
Annual Grid investments vs previous decade	1.3-1.5x	1.7-1.9x	3.5-4x
Grid Regulated Return Spread (WACC vs Local 10yr)	~4%	~3%	~2%
EPS upside on our Most Preferred stocks	~5%	~8%	~4%
Key Stocks	Reliance, CATL, Tenaga, Hokkaido Electric, Keppel	VST, TLN, NEE, AES, BE, GEV, SRE	RWE, ENGIE, SSE
Valuations Premium vs Mid Cycle Avg.	2%	20%	3%
Similarities			

Consumption Growth Above Last Decade
Power Markets are getting tighter
Power prices are expected to remain higher for longer
More Batteries or/and Fossil baseload to balance the grid

Source: Morgan Stanley Research

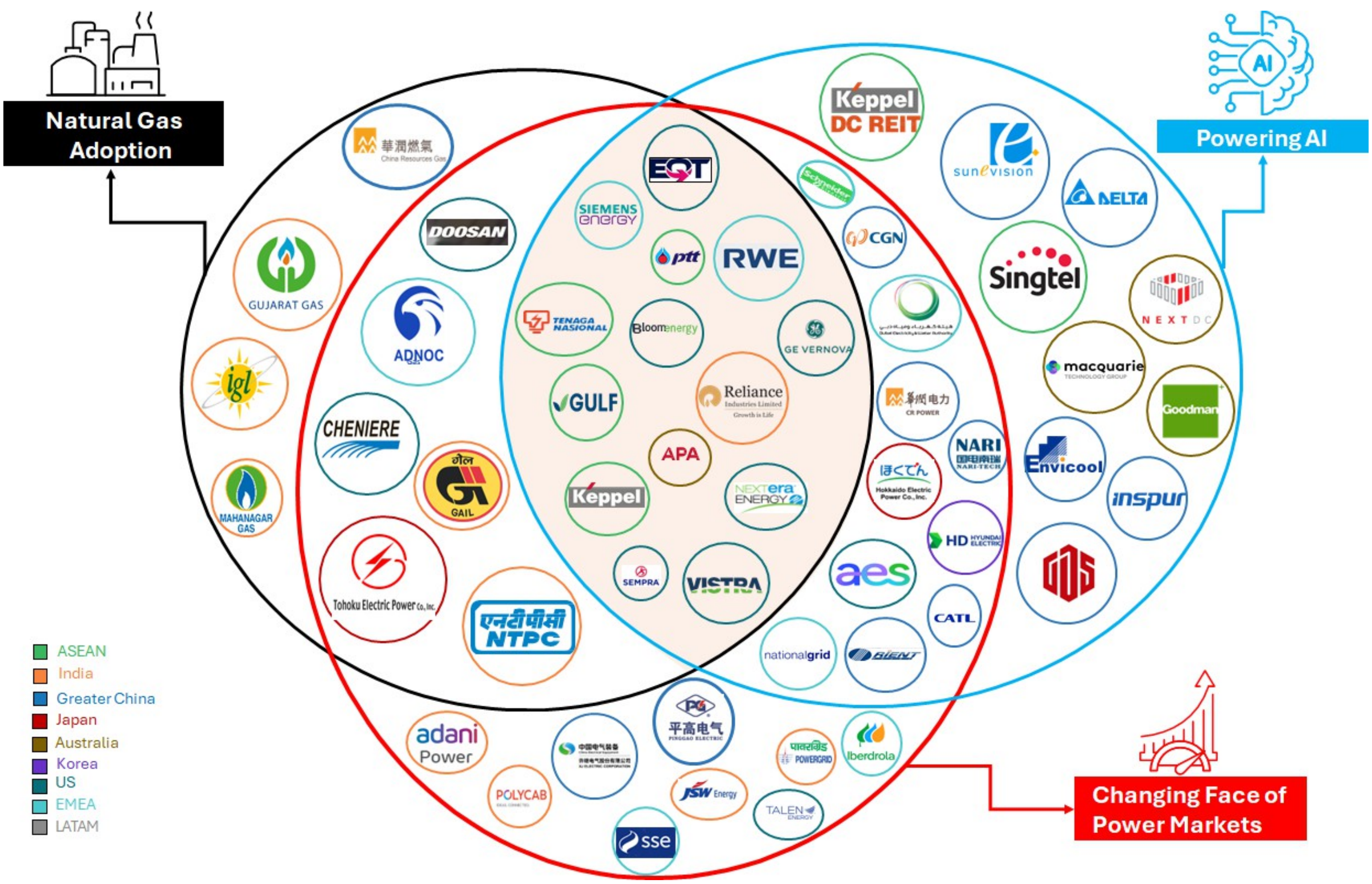
Ways to Play

We highlight a list of 47 equities around the world that benefit directly and via supply chains from the changing face of the power market. While each market has its nuances, we believe those companies that facilitate improving power shortages and also help accelerate AI adoption are key beneficiaries. As we are now in the second leg of the story, we prefer power generators, gas pipeline operators, battery suppliers, grid operators and remain selective in renewables and equipment players. These companies should deliver 15% earnings growth 2024-2027e CAGR and see 300bps expansion in ROE with 5-15% upside risk to street 2026/2027 earning estimates (Exhibit 19). We estimate US$350bn in market upside potential for these equities (Exhibit 14).

We expect the valuation differentials that emerged for early beneficiaries of power tightness will reduce as the rest of the supply chain catches up and see multiple triggers for earnings revisions, with the key being spreads and volume growth for power/natural gas and higher investments in grid infrastructure.

Key global stock picks: EQT, Vistra, NextEra, Reliance, Adani Power, JSW Energy, RWE, CATL, Tenaga, Keppel Corp, Hokkiado Electric.

Exhibit 13: Looking at our global Morgan Stanley Research coverage across multiple sectors, we see three thematics intersecting. Gas pipeline and power producers stand to benefit the most



Source: Morgan Stanley Research. *We see our previous global thematic notes of Natural Gas Adoption and Powering AI intersecting with the Changing Face of Power Markets which we highlight below. For the full list of preferred ways to play Natural Gas Adoption and Powering AI, please refer to the appendix.

Exhibit 14: Playing the Changing Face of Power: Globally we have 40 most preferred equities and 7 least preferred equities

Rank	Company Name	Ticker	Market cap, current, USD (MM)	3M ADTV, USD (MM)	Rating	Share price, last close	Price Target (Local CCY)	% Upside from last close	Geography	Sub-Sector	Key Exposure Thesis	MS Analyst
Most Preferred												
Power Generators												
1	NextEra Energy	NEE.N	178,875	197	Overweight	83.88	98.00	16.8%	USA	Diversified IPP	Expanding renewable portfolio	David Arcaro
2	Gulf Development	GULF.BK	19,470	31	Overweight	41.50	69.00	66.3%	Thailand	Diversified IPP	Integrated DC + generation portfolio	Mayank Maheshwari
3	RWE	RWEG.DE	40,364	81	Overweight	45.69	52.00	13.8%	Germany	Diversified IPP	Tight electricity markets rewarding flexibility + value creation in renewables in Europe & US	Robert Pulleyn
4	Adani Power	ADAN.NS	33,140	97	Overweight	153.91	185.00	20.2%	India	Thermal Power	Play on India's Energy Security and Transition	Girish Achhipalia
5	Hokkaido Electric Power	9509.T	1,471	51	Overweight	1,065.00	1,450.00	36.2%	Japan	Integrated Power Utility	The company's service area is cooler hence making Hokkaido an advantageous location for AI datacenters	Reiji Ogino
6	Vistra Corp	VST.N	60,402	182	Overweight	174.69	223.00	27.7%	USA	Diversified IPP	Tight electricity markets + Nuclear	David Arcaro
7	JSW Energy	JSWE.NS	10,428	13	Overweight	528.80	693.00	31.1%	India	Diversified IPP	Play on India's Energy Security and Transition	Girish Achhipalia
8	Talen Energy	TLN.O	16,792	368	Overweight	360.92	441.00	22.2%	USA	Diversified IPP	Tight electricity markets + Nuclear	David Arcaro
9	NTPC	NTPC.NS	35,869	34	Overweight	328.45	409.00	24.5%	India	Diversified IPP	Play on India's Energy Security and Transition	Girish Achhipalia
10	Keppel	KPLM.SI	14,257	27	Overweight	10.04	11.54	14.9%	Singapore	Diversified IPP	Tight electricity markets as Singapore expands DC capacity	Mayank Maheshwari
11	EDP	EDP.LS	18,537	39	Equal-Weight	3.83	3.90	1.9%	Portugal	Diversified IPP	Value creation in EU & US renewables + integrated model adapted to the new more complex power system	Arthur Sitbon
12	Tohoku Electric Power	9506.T	3,494	18	Overweight	1,079.00	1,520.00	40.9%	Japan	Integrated Power Utility	Benefits from cheaper gas cost in gas trading & power generation business	Reiji Ogino
13	AES Corp	AES.N	10,020	34	Overweight	13.82	24.00	73.7%	USA	Diversified IPP	Expanding renewable portfolio	David Arcaro
14	DEWA	DEWAA.DU	37,438	6	Equal-Weight	2.74	3.20	16.8%	UAE	Integrated Power Utility	Electricity demand growth in Dubai + increased exposure to renewables	Ricardo Rezende
15	CGN Power	1816.HK	4,424	26	Overweight	3.03 HKD	2.81 HKD	-7.3%	China	Nuclear	Nuclear generator, beneficiary of volume growth	Albert Li
16	China Resources Power	0836.HK	12,949	43	Overweight	19.00	23.70	24.7%	China	Diversified IPP	Baseload + Renewables	Albert Li
Grid Operators												
1	SSE	SSE.L	33,645	71	Overweight	2,227.00 GBp	2,400.00 GBp	7.8%	UK	Grid Operator	Transmission infrastructure growth + renewable deployment	Robert Pulleyn
2	Power Grid (India)	PGRD.NS	28,089	39	Equal-Weight	271.30	295.00	8.7%	India	Grid Operator	Transmission infrastructure growth in India	Girish Achhipalia
3	Tenaga Nasional	TENA.KL	18,886	14	Overweight	13.42	16.30	21.5%	Malaysia	Integrated Power Utility	Single grid operator benefits from power demand + renewables grid capex	Mayank Maheshwari
4	National Grid	NG.L	76,792	124	Overweight	1,169.50 GBp	1,275.00 GBp	9.0%	UK	Grid Operator	Transmission infrastructure growth in UK & US	Sarah Lester
5	Sempra	SRE.N	60,353	108	Overweight	92.00	99.00	7.6%	USA	Grid Operator	Transmission infrastructure growth	David Arcaro
6	Iberdrola SA	IBE.MC	138,451	123	Equal-Weight	18.04	18.00	-0.2%	Spain	Grid Operator	Transmission infrastructure growth + renewable deployment	Robert Pulleyn
Gas Players												
1	Petrochina	0857.HK	24,625	103	Overweight	8.79 HKD	10.25 HKD	16.6%	China	Gas Producer	Domestic gas pricing reforms	Jack Lu
2	GAIL	GAIL.NS	13,564	17	Overweight	183.41	236.00	28.7%	India	Gas Transmission	Integrated Gas Player	Mayank Maheshwari
3	Cheniere Energy Inc	LNG.N	45,963	101	Overweight	215.19	258.00	19.9%	USA	LNG Export	LNG Export Demand	Devin McDermott
4	EQT Corp	EQT.N	37,968	102	Overweight	59.90	69.00	15.2%	USA	Gas Producer	LNG Export Demand	Devin McDermott
5	ADNOC Gas	ADNOCGAS.AD	71,471	24	Equal-Weight	3.39 AED	3.90 AED	15.0%	UAE	Gas Processing + LNG/LPG Export	Domestic gas demand in the UAE + LPG/LNG exports	Ricardo Rezende
6	PTT Group	PTT.BK	26,651	54	Overweight	30.50	34.80	14.1%	Thailand	Integrated Energy	Integrated Gas Player	Mayank Maheshwari
Grid Equipment												
1	CATL	300750.SZ	239,432	1,790	Overweight	404.12	490.00	21.3%	China	Battery Energy Storage	Higher renewable curtailments require more storage	Jack Lu
2	Schneider Electric	SCHN.PA	159,792	227	Overweight	235.65	280.00	18.8%	France	Power Grid Equipment	Power demand growth requires grid hardening capex	Max Yates
3	NARI Tech	600406.SS	27,199	221	Overweight	23.80	26.51	11.4%	China	Power Grid Equipment	Power demand growth requires grid hardening capex	Eva Hou
4	HD Hyundai Electric	267260.KS	20,926	82	Overweight	824,000.00	900,000.00	9.2%	S. Korea	Power Grid Equipment	Power demand growth requires grid hardening capex	Ryan Kim
5	Polycab India	POLC.NS	13,073	20	Overweight	7,632.00	8,672.00	13.6%	India	Wires and cables	Targets 10% export exposure by F26	Girish Achhipalia
6	Ningbo Orient Wires & Cables	603606.SS	5,738	100	Overweight	60.77	69.63	14.6%	China	Wires and cables	Targets 10% export exposure by F26	Eva Hou
7	Pinggao Electric	600312.SS	3,503	83	Overweight	17.95	19.88	10.8%	China	Power Grid Equipment	Power demand growth requires grid hardening capex	Eva Hou
Gas/Nuclear Power Equipment												
1	GE Vernova	GEV.N	156,118	318	Overweight	578.31	710.00	22.8%	USA	Gas Turbines	Higher demand for gas baseload drives turbine sales	David Arcaro
2	Siemens Energy	ENR1n.DE	107,045	248	Overweight	110.50	120.00	8.6%	Germany	Gas Turbines	Higher demand for gas baseload drives turbine sales	Max Yates
3	Doosan Enerbility	034020.KS	34,379	372	Equal-Weight	78,400.00	88,000.00	12.2%	Korea	Nuclear Equipment	Nuclear Renaissance	Heewon Choi
Renewable Equipment												
1	Bloom Energy	BE.N	29,971	204	Overweight	111.89	155.00	38.5%	USA	Fuel Cells	Powering AI drives demand for faster time to power	David Arcaro
2	Reliance Industries	RELI.NS	231,279	170	Overweight	1,518.90	1,701.00	12.0%	India	Solar Module	New Energy equipment manufacturing ramps up	Mayank Maheshwari
Least Preferred												
1	Hoyuan	603185.SS	3,217	102	Equal-Weight	37.50	21.80	-41.9%	China	Solar Module	Solid execution weighed down by vertical integration	Eva Hou
2	Longi	601012.SS	22,137	566	Underweight	21.88	14.01	-36.0%	China	Solar Module	We expect consistently low unit gross profit due to oversupply	Eva Hou
3	Tongwei	600438.SS	15,878	372	Equal-Weight	25.76	21.85	-15.2%	China	Solar Module	EW; await opportunity when poly prices recover	Eva Hou
4	Goldwind	2208.HK	1,250	38	Equal-Weight	12.88 HKD	11.82 HKD	-8.2%	China	Wind	Remain EW on ongoing WTG GPM pressure	Eva Hou
5	JA Solar	002459.SZ	6,525	158	Equal-Weight	14.48	13.98	-3.5%	China	Solar Module	Margin pressure during industry downcycle	Eva Hou
6	Consolidated Edison	ED.N	36,162	65	Underweight	101.66	100.00	-1.6%	USA	Integrated	Below-average earnings growth vs peers	David Arcaro
7	Vestas	VWS.CO	25,728	51	Equal-Weight	155.60 DKK	160.00 DKK	2.8%	Denmark	Wind	Dominant Wind Turbine Manufacturer, Demanding Valuations	Max Yates

Source: Morgan Stanley Research; Priced as at 14 November 2025

Exhibit 15: Global Power: Stacking up power markets around the globe: US, Malaysia, Middle East and India stack well

Country	Demand Growth	Market Tightness		Capacity Growth		Energy Security	Regulatory Environment	Valuations	Overall
		Base Load Tightness	Grid Tightness	Base Load Growth	Renewable Growth				
US	4.0	5.0	5.0	3.0	3.0	4.5	3.5	3.0	**3.9**
UK	2.0	4.0	4.0	3.0	3.0	3.5	4.0	4.0	**3.4**
Europe	2.0	4.0	4.0	3.0	3.0	3.5	4.0	4.0	**3.4**
Mexico	2.0	4.0	4.0	2.0	1.0	3.0	2.0	3.0	**2.6**
Brazil	3.0	2.0	2.5	3.5	4.0	4.0	4.0	3.0	**3.3**
Chile	4.0	2.5	3.0	4.0	4.5	3.0	3.0	3.0	**3.4**
UAE	3.0	3.0	3.0	3.0	2.0	4.8	5.0	3.5	**3.4**
China	4.5	3.0	4.0	3.5	4.5	4.5	4.0	3.0	**3.9**
India	4.5	4.5	4.5	4.0	5.0	4.0	3.5	4.5	**4.3**
Australia	3.0	3.0	5.0	2.0	4.0	4.5	4.5	3.0	**3.6**
Japan	1.0	3.0	3.0	2.0	2.0	4.0	4.0	3.5	**2.8**
Thailand	2.0	2.0	2.0	2.0	2.0	3.5	3.0	4.5	**2.6**
Malaysia	4.5	3.5	3.0	4.0	3.5	4.5	4.5	4.5	**4.0**
Singapore	4.0	4.5	3.0	4.5	1.0	3.5	4.5	3.0	**3.5**
Indonesia	2.0	1.0	2.0	1.0	1.0	4.0	3.0	3.0	**2.1**
Philippines	3.5	4.5	4.0	4.0	3.0	3.0	3.5	3.0	**3.6**

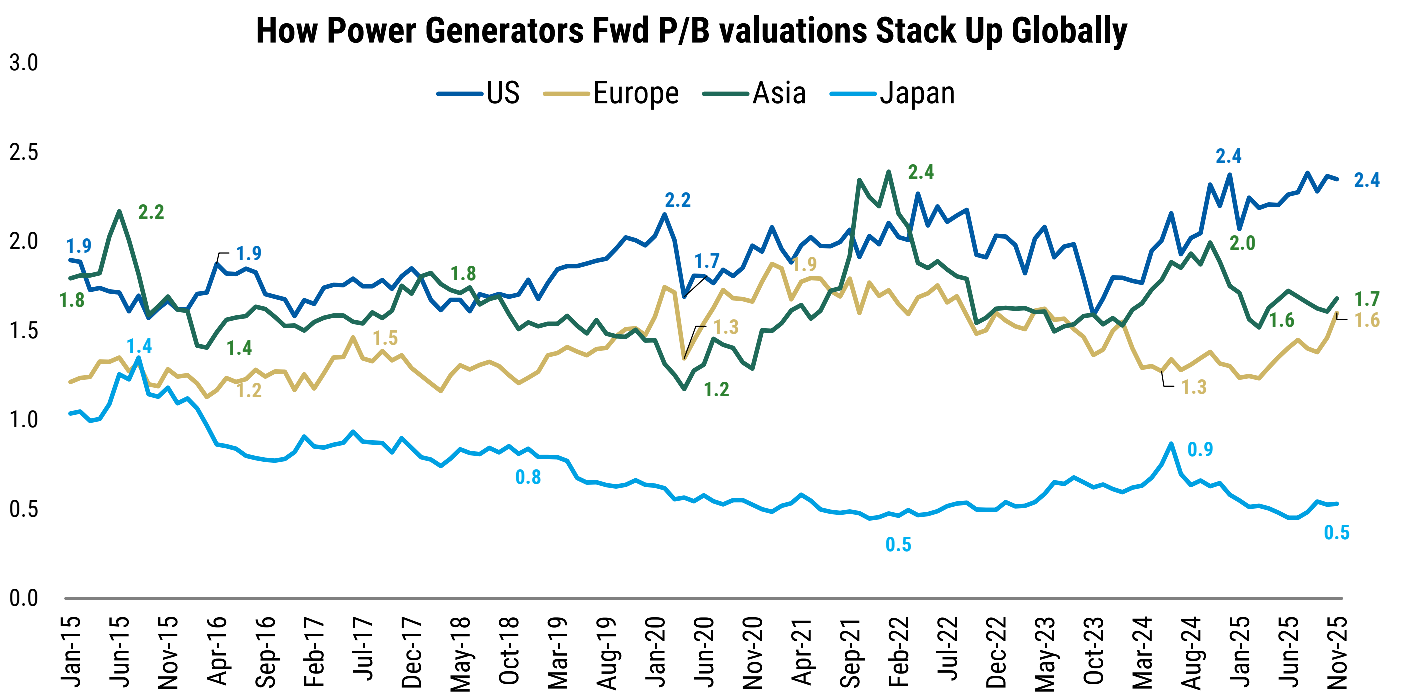
Source:Morgan Stanley Research Estimates

Ranked 1-5, Demand Growth: High demand growth = higher score, Base Load Tightness: Excess baseload capacity = Lower Score, Grid Tightness: Excess grid capacity = Lower Score, Base Load Growth: More base load capacity growth= higher score, Renewable Growth: More renewable capacity growth= higher score, Energy Security: Higher delivered Fuel costs or lower availability to energy = lower score, Regulatory Environment: More favourable to incremental investments = higher, Valuations: Attractive valuations relative to growth outlook = higher

Power Valuations: Changing in the Face of Demand

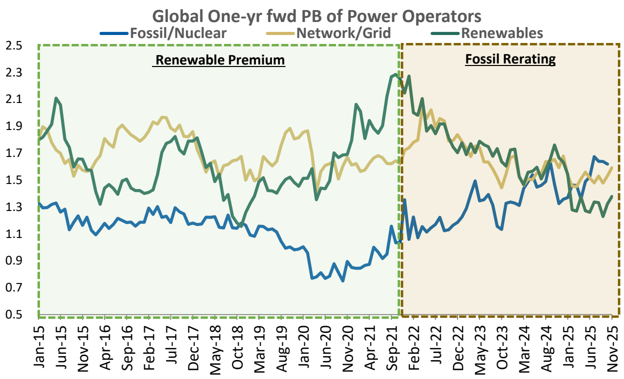
We believe multiples for power stocks on each continent are resetting to a new normal as power markets undergo immense change. In the past two years, renewable stocks have consistently derated while fossil-based generation stocks have re-rated by 30-40% across global markets (Exhibit 17). We believe companies that help reduce power constraints will continue to re-rate, and expect multiples for gas/nuclear-based generation and the associated supply chain for equipment, as well as midstream pipeline players supplying natural gas and power generation to remain elevated. Grid companies have seen their valuations re-rate 15% in past two years (Exhibit 18), and regulators are allowing 20-30% CAGR in new grid investments, which should support the next leg of value creation above the cost of capital over the next five years.

Exhibit 16: Global Valuations in Perspective: US power supply chain is trading at a premium to Asia and Europe due to better earnings growth outlook from Powering AI demand



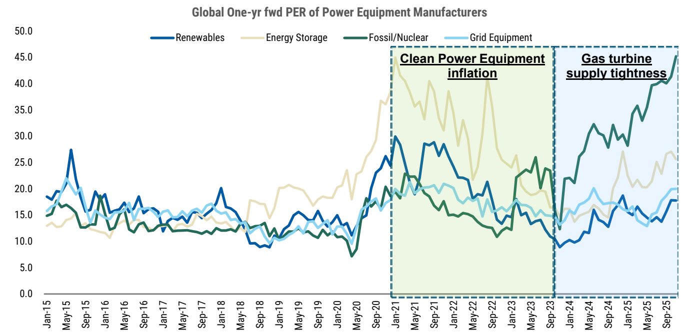
Source: Refinitiv, Morgan Stanley Research

Exhibit 17: Clean power generators have seen valuations de-rate 40% from peaks, while conventional players outperformed. We expect the fossil-fuel premium to continue



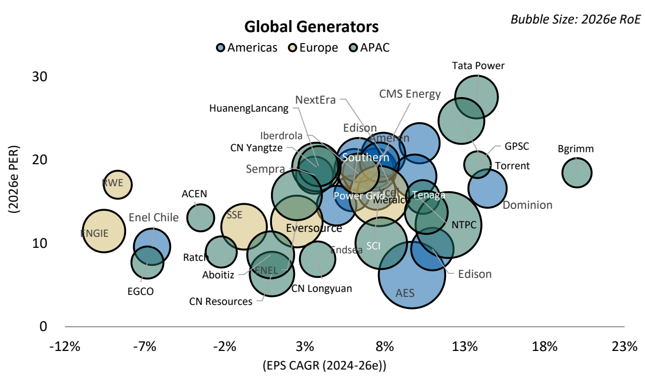
Source: Refinitiv, Morgan Stanley Research

Exhibit 18: In the equipment space, gas turbine and grid equipment stocks have outperformed



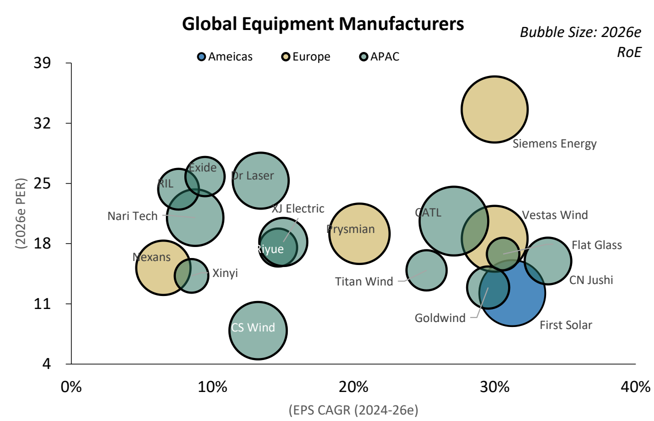
Source: Refinitiv, Morgan Stanley Research

Exhibit 19: Global power generators: renewables + gas/nuclear likely to see higher ROEs



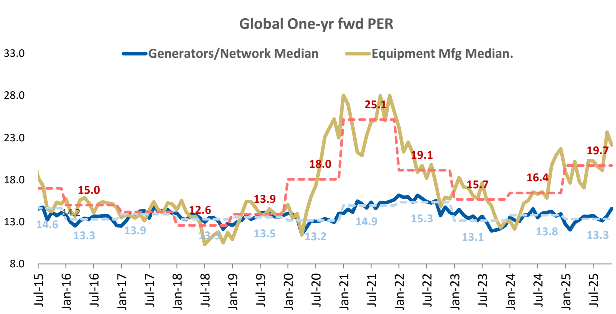
Source: Refinitiv consensus estimates, Morgan Stanley Research

Exhibit 20: Global equipment manufacturers for power should re-rate as domestic players (outside China) take market share and outperform



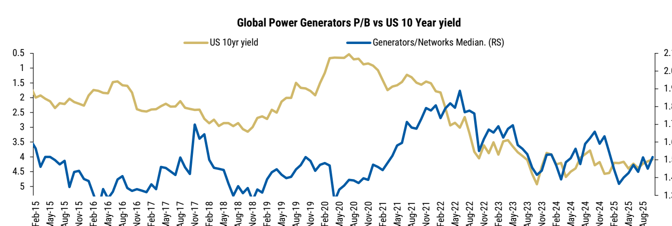
Source: Refinitiv consensus estimates, Morgan Stanley Research

Exhibit 21: Equipment supply tightness drove outperformance of manufacturers over operators



Source: Refinitiv, Morgan Stanley Research

Exhibit 22: Power generators should outperform as global interest rates reduce



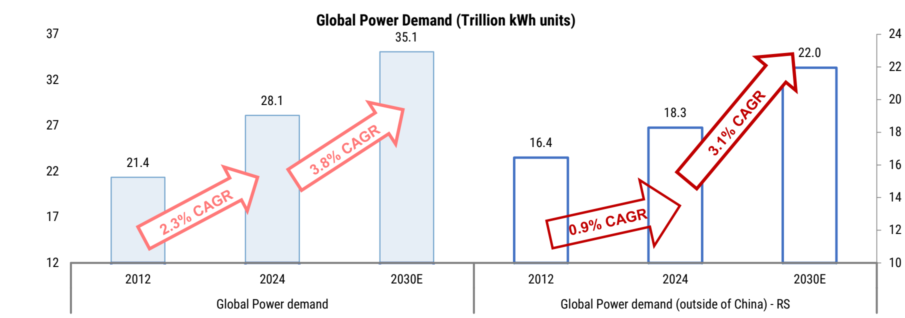
Source: Refinitiv, Morgan Stanley Research

Power Demand Continues to Surge

In our note, Global Power: At a Tipping Point, we highlighted power consumption was at another tipping point after tripling since 1980, which is being driven by AI power consumption, new supply chains forming and electrification. We remain positive on global power consumption and raise our consumption growth forecasts by 30bps to 3.8% by 2030 (Exhibit 23). This is driven by strong growth in the US, Europe, Japan and Malaysia. We also see a greater portion of demand being met by gas, as renewable curtailments continue to rise globally.

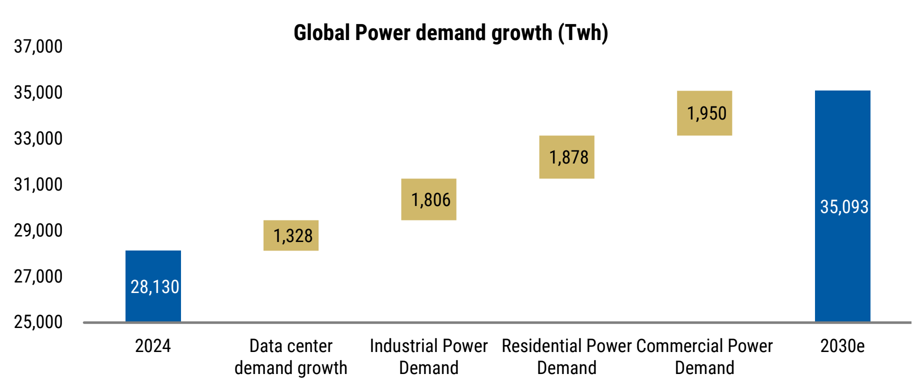
We now expect the US, Europe and Japan to raise power demand ~2-3x faster than in the previous decade, achieving growth last seen in the early 2000s, while China and Southeast Asia continue to grow at the same expected rate. (Exhibit 26) Alongside a significant step up in AI power demand, ambitions to increase power self sufficiency in advanced economies have driven new supply chain formation and increased industrial power demand. Excluding weather effects on power demand, since 2012 we have seen industrial and commercial sector demand for power rise faster than ever in the US, Europe, Japan and Taiwan. That said, China's anti-involution policy is a risk that could negatively affect industrial power demand, as it reduces overcapacity and increases renewable curtailments.

Exhibit 23: We expect power demand to inflect globally driven by data centers, new supply chains and electrification of industry



Source: Statistical Review of World Energy, Morgan Stanley Research estimates

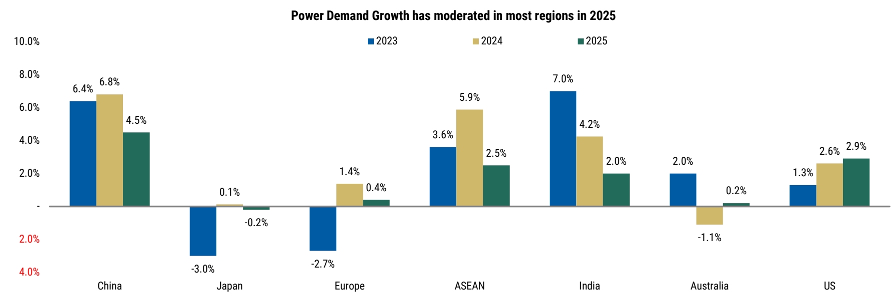
Exhibit 24: We estimate data centers, new supply chains and electrification could drive global power demand for the rest of the decade



Source: Company data, Morgan Stanley Research Estimates

In 2024, global electricity demand surged by around 4.4%, a significant acceleration from the 2-2.6% seen in 2023 (Exhibit 26). This was driven by very warm weather, rapid electrification, and strong industrial activity. Power demand growth in YTD 2025 has moderated to ~3% as temperatures have been cooler than in 2024 and amid slower industrial activity due to trade tariff uncertainty, but we see strong underlying trends from new data center and supply chain buildouts as well as improving domestic consumption patterns.

Exhibit 25: Power demand has moderated globally in 2025 on cooler weather and trade uncertainty in the first half of 2025

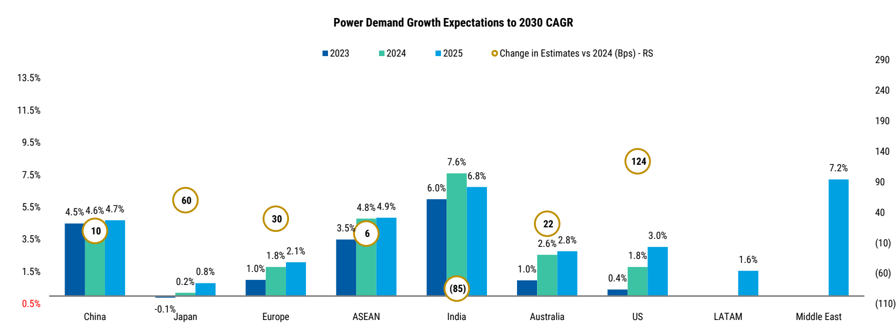


Source: IEA, IEA, OCTO, IEX, Company Data, Morgan Stanley Research

What does our Global Power Model Suggest?

In US, we see the landscape for power demand fundamentally changing in the near term, accelerating at a ~3% CAGR through 2030, largely driven by data center growth. In Europe, we forecast a 2024-30 gross power demand CAGR of 2.1%, or 390 TWh, in total growth, which implies Europe regains the lost power consumption of 2022-23 by 2027. In Asia, we believe the underlying consumption for power in industrial and commercial segments have outperformed our base case expectations, driving our core expectations higher by 10-60bps in Asia (adjusted for extreme weather in 2024). (Exhibit 26)

Exhibit 26: Our power demand expectations have been revised up globally



Source: Morgan Stanley Research estimates

Exhibit 27: Our Global Power Generation Model suggests ~35trn kWh of annual power demand by 2030

Power Demand	2023	2024	2025e	2026e	2027e	2028e	2029e	2030e
Data Center power demand (TWh)	451.4	534.1	707.3	883.6	1,071.8	1,297.6	1,549.3	1,862.1
Non Data Center power demand (TWh)	26,515.5	27,596.2	28,433.4	29,402.7	30,377.1	31,338.8	32,305.2	33,230.9
Total Power Demand (TWh)	26,966.9	28,130.3	29,140.7	30,286.3	31,448.9	32,636.4	33,854.4	35,093.0
Power Generation	**2023**	**2024**	**2025e**	**2026e**	**2027e**	**2028e**	**2029e**	**2030e**
Total Power generation (TWh)	29,963.2	31,255.9	32,350.8	33,569.0	34,832.9	36,125.7	37,459.7	38,865.3
Coal (TWh)	10,461.0	10,613.2	10,311.4	10,252.7	10,163.4	10,047.0	9,927.7	9,792.9
Installed Capacity (GW)	2,141.0	2,150.0	2,198.7	2,247.1	2,304.4	2,346.8	2,402.1	2,444.6
Load Factor	56%	56%	54%	52%	50%	49%	47%	46%
Nuclear (TWh)	2,737.6	2,817.5	2,868.1	2,934.4	3,012.0	3,101.0	3,197.6	3,264.5
Installed Capacity (GW)	395.0	402.0	408.9	417.0	428.5	438.9	451.6	458.2
Load Factor	79%	80%	80%	80%	80%	81%	81%	81%
Renewables & Others (TWh)	9,954.9	10,824.0	12,026.1	13,104.8	14,188.6	15,218.6	16,265.0	17,335.0
Installed Capacity (GW)	4,655.0	5,315.0	5,982.8	6,669.2	7,284.6	7,890.9	8,514.1	9,135.4
Load Factor	24%	23%	23%	22%	22%	22%	22%	22%
Natural Gas (TWh)	6,809.7	7,001.2	7,145.5	7,277.2	7,468.8	7,758.6	8,068.7	8,471.8
Installed Capacity (GW)	1,809.0	1,833.0	1,870.0	1,905.8	1,947.4	1,992.0	2,038.7	2,090.2
Load Factor	43%	44%	44%	44%	44%	44%	45%	46%
CCGT Heatrate (BTU/kwh)	7,486	7,494	7,556	7,588	7,642	7,657	7,685	7,707
Total Gas consumed for Power (mntpa)	984.1	1,012.9	1,042.3	1,066.1	1,101.8	1,146.9	1,197.1	1,260.4

Source: Statistical Review of World Energy, Morgan Stanley Research Estimates

Exhibit 28: How Countries Stack up on Demand and prices

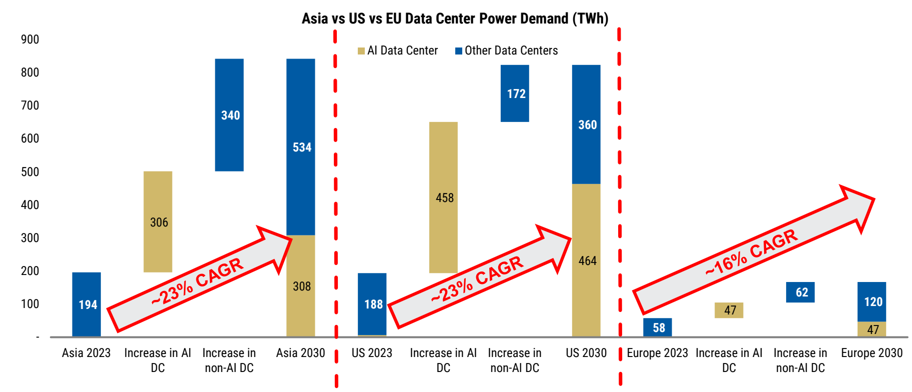
Country	Power Demand CAGR (2025-30)	Incremental Power demand (2025-30) (TWh)		Baseload Power Cost (US$/MWh)	Delivered Power Price (US$/MWh)
		Datacenters	Non-Datacenters		
US	3.04%	512	137	85	~100
Europe	2.10%	94	236	65-98	160-170
LATAM	1.57%	0	126	65	160
Middle East	7.23%	22	300	40	60
China	4.70%	317	2,380	60	87
India	6.75%	46	622	55	90
Japan	0.80%	27	6	90	214
Australia	2.78%	9	25	76	220
ASEAN (ex Singapore)	4.86%	92	203	76	106
Singapore	3.20%	8	4	92	~200

Source: Company Data, Bloomberg, IEX, EMA Singapore, EPPO Thailand, JPEX, Morgan Stanley Research Estimates

AI's Power Appetite: In Perspective

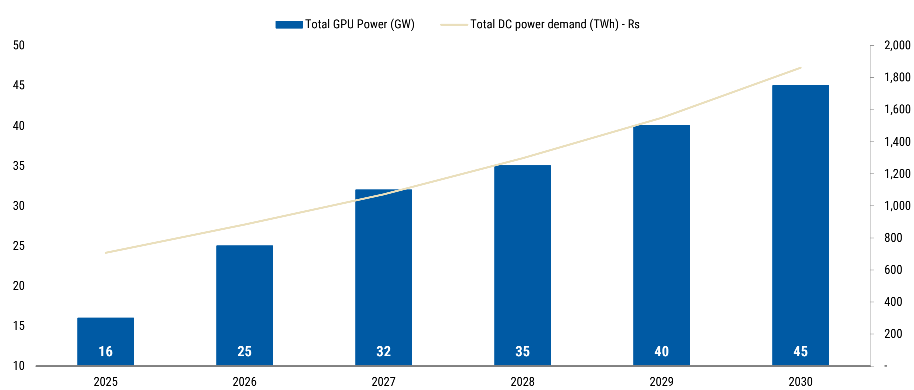
Data centers currently account for ~2% of global power consumption and we forecast they will add 1.2 trillion units (20% of total incremental power demand) to global power consumption, accounting for ~5% of power demand by 2030. While there will be varied adoption rates globally, about 45% of these units will be consumed in Asia, 45% in US, with Europe largely accounting for the rest of data center power consumption. We see 25% CAGR growth in power consumption from data centers in 2024-27e and 20% CAGR in 2027-30e. We expect data centres to account for ~75% of US power demand growth by 2030, while in Europe they will account for ~40% and Asia they will account for ~13%.

Exhibit 29: How data center power demand compares globally



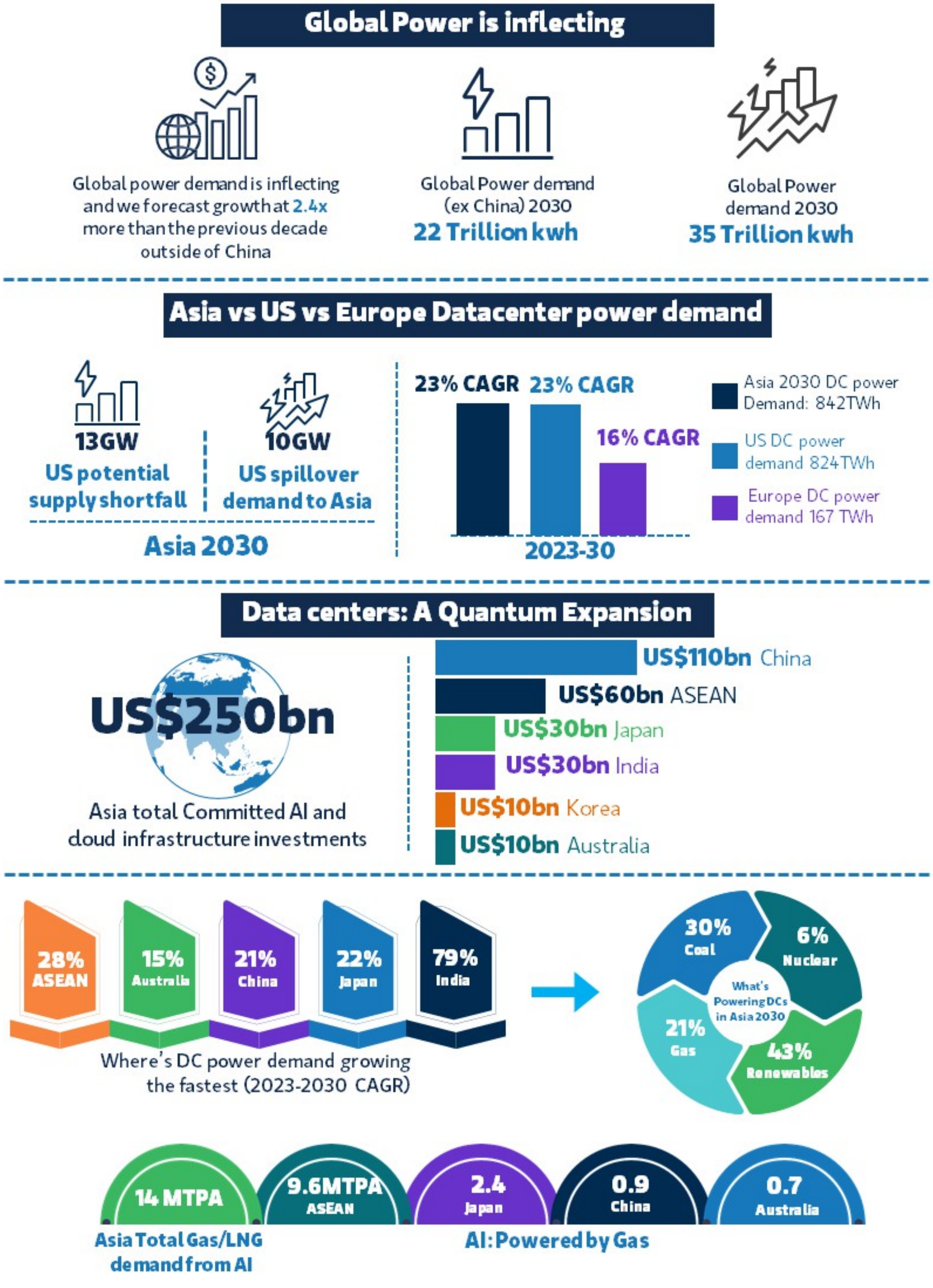
Source: Morgan Stanley Research Estimates

Exhibit 30: Global DC power demand is growing along with total GPU power



Source: Morgan Stanley Research Estimates

Exhibit 31: Asia is set to lead the next wave of global power growth — driving data-center demand, we expect US$250bn in AI and cloud investments, and a major shift in electricity and gas use by 2030e.



Source: Morgan Stanley Research estimates

The AI Math: Understanding the Impact of Power Costs

Our analysis of a 100MW AI hyperscaler reveals an interesting dynamic; that AI hyperscalers are simply price insensitive to power. We estimate only a ~100bp points impact when power prices are raised by ~17% (from US$120/MWh to US$140/MWh) keeping hyperscalers' ROEs well above 20%, even if power prices rise 1.5x the current rate to ~US$160/MWh. (Exhibit 32) We see opportunities for power utilities to further differentiate pricing for data centers, which will help to fund additional grid and generation capacity expansion as well as lift returns in the long run.

Exhibit 32: ROE Sensitivity of a AI hyperscaler

Price per 1M Output tokens (US$)		Cost of Power (US$/MWh)						
		100	110	120	130	140	150	160
	10.5	20.0%	19.5%	19.1%	18.6%	18.2%	17.7%	17.3%
	11.0	22.3%	21.8%	21.4%	20.9%	20.5%	20.0%	19.6%
	11.5	24.6%	24.2%	23.7%	23.3%	22.8%	22.4%	21.9%
	12.0	26.9%	26.5%	26.1%	25.6%	25.2%	24.7%	24.3%
	12.5	29.3%	28.8%	28.4%	27.9%	27.5%	27.0%	26.6%

Source: Morgan Stanley Research Estimates

Power costs have one of the lowest impacts on AI hyperscaler earnings. For a 20% change in power prices, we estimate earnings are only impacted ~5%. This is significantly less than other factors, such as revenue per token, model/GPU energy efficiency (which is only improving with each model evolution) and GPU asset life, which has a 15-23% impact to earnings. Our analysis also suggests that returns and profitability of AI hyperscalers are more affected by the pricing, model efficiency and capital cost (data center capex, GPU capex) rather than variable operating costs (power, water consumed).

Our analysis takes into account current prices of NVIDIA's H100 GPUs at a six-year asset life and 75th percentile data center construction costs. Our estimates also factor the current pricing of AI inference charged by OpenAI. Below are our key findings:

Exhibit 33: Illustrative returns of a 100MW AI hyperscaler

100MW Economics (US$ mn)	
Revenue	1,067
Cost of Power	(107)
Cost of Water	(3)
Operating Costs	(5)
EBITDA	**952**
Margin	*89%*
Powered shell Depreciation	(77)
GPU Depreciation	(339)
Operating Income	**536**
Margin	*50%*
Interest Cost	(64)
PBT	**472**
Tax	(94)
Net Profit	**378**
Net Profit Margin	***35%***
ROCE	**16.8%**
ROE	**23.7%**

Source: Morgan Stanley Research Estimates

Exhibit 34: Illustrative per token economics for an AI hyperscaler

Per Token Economics (US$/ mn output Token)	
Revenue	11.5
Cost of Power	(1.2)
Cost of Water	(0.0)
Operating Costs	(0.1)
EBITDA	**10.3**
Margin	*89%*
Powered shell Depreciation	(0.8)
GPU Depreciation	(3.7)
Operating Income	**5.8**
Margin	*50%*
Interest Cost	(0.7)
PBT	**5.1**
Tax	(1.0)
Net Profit	**4.1**
Net Profit Margin	***35%***

Source: Morgan Stanley Research Estimates

Exhibit 35: Capital Cost Assumptions

Capital Costs (US$mn /MW)		
Powered Shell	11.50	
Land		3.0
Power+Cooling		3.5
Networking Equipment & Server Racks		5.0
GPU Costs	20.4	
Price per GPU (US$)		30,000
GPUs per Server		8.0
Power per Server (kW)		11.8
Total Capex (US$/MW)	31.9	
Powered Shell Asset Life (yrs)		15
GPU Asset Life (yrs)		6

Source: Morgan Stanley Research Estimates

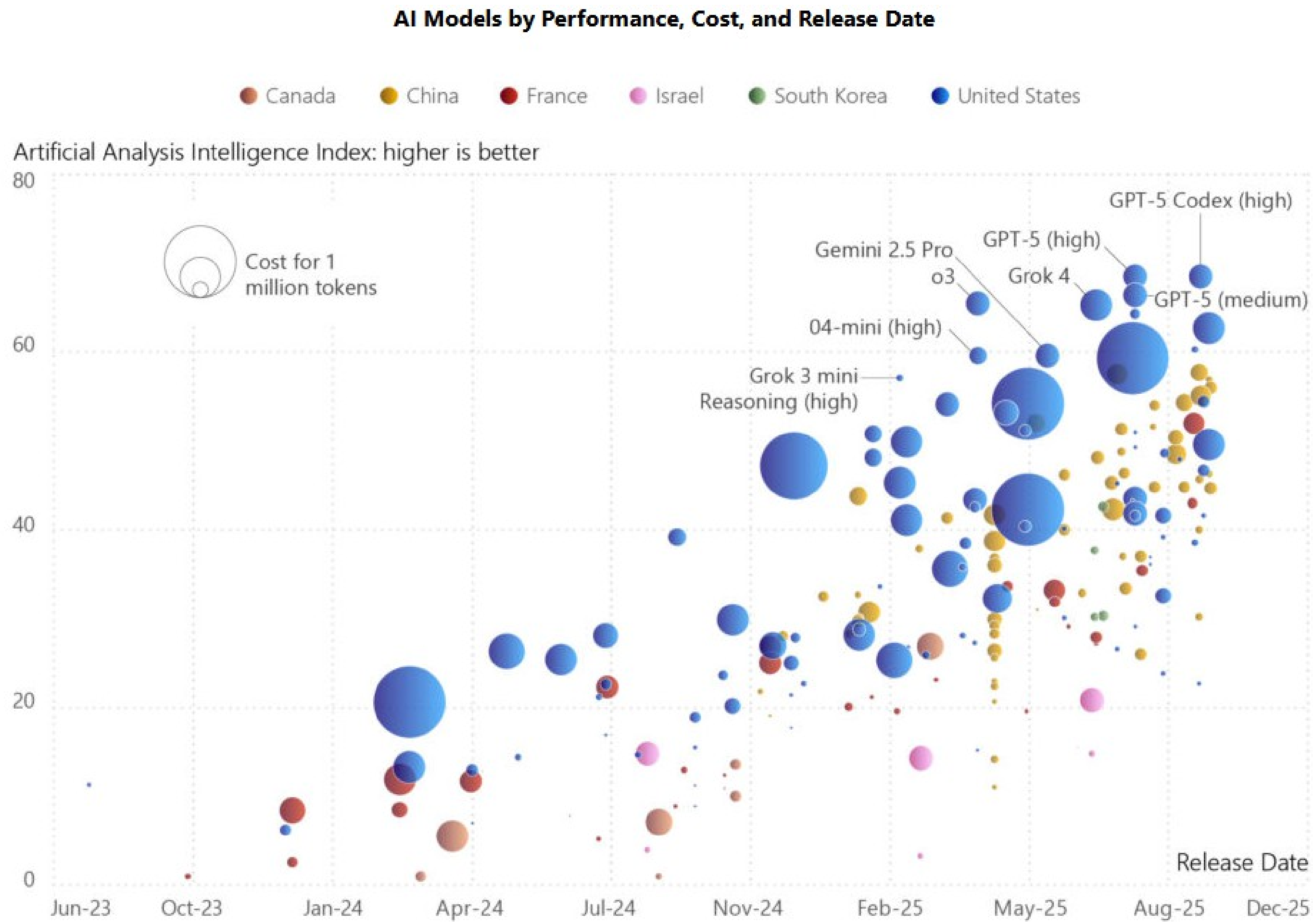
Exhibit 36: Operating Assumptions

Operating Parameters	
Compute Capacity (MW)	100
Utilization	85%
Total Compute Power (MWh)	744,600
PUE	1.2
WUE (L/kwh)	1.5
Power Usage (MWh)	893,520
Water Usage (ML)	1,340.28
Operating Cost Assumptions	
Cost of Electricity (US$/MWh)	120
O&M costs (US$ mn/MW p.a.)	0.05
Cost of Water (US$/L)	0.002

Source: Morgan Stanley Research Estimates

Exhibit 37:

How AI Models compare on performance and costs

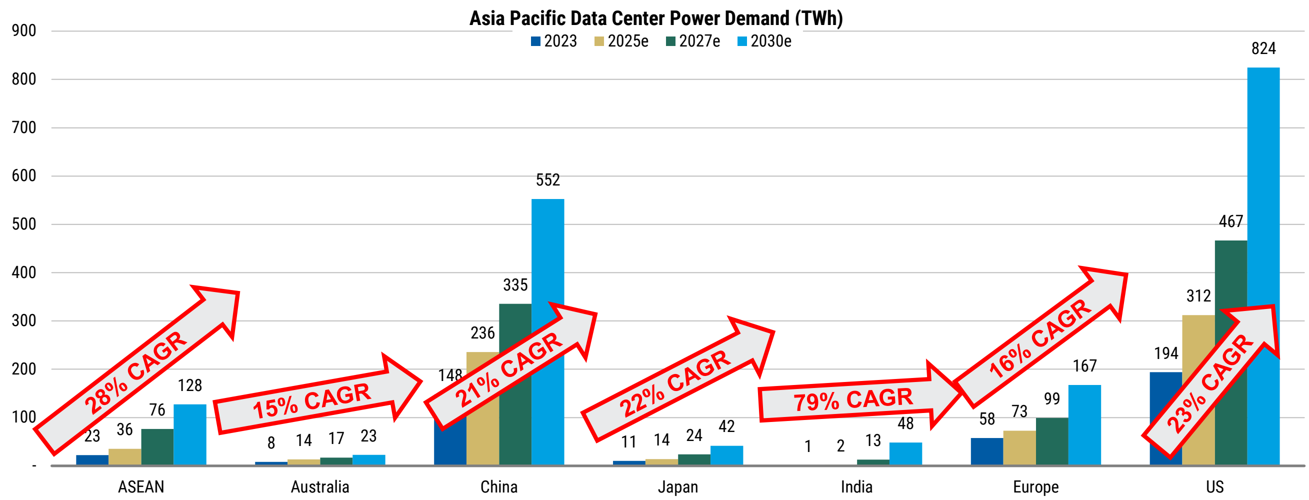


Source: Microsoft AI Diffusion Report

Powering AI

Power demand in Asia (including Japan), which includes data center capacity, is set to triple, to 100+GW by 2030 on our forecasts, and form more than a third of global data center capacity. (Exhibit 38) Power demand growth is on track to double in Malaysia, Japan is reversing its multi-decade decline in power demand, and Australia, Taiwan and Singapore are seeing tighter power markets. Natural-gas-fired power plants – currently the most accessible means to dispatch power – are the most likely form of power generation that can fill the power requirement void apart from renewables (which also will need more natural gas or batteries to balance the grid), while nuclear infrastructure is being constructed/expanded. As the gas glut rises globally and prices fall to more competitive levels (Exhibit 18) compared to other alternatives, the upside across the gas value chain, including gas-fired power producers, should lead to upside risks in earnings and also multiple re-rating. In China, while we expect DCs will make up 4% of total power consumption by 2030, a large part of this will be generated by renewables, similar to what we assume in Europe. However, DCs' renewable power adoption will raise gas-based generation requirements from other industries. In Europe, we estimate data centres represent 36% of power demand growth to 2030, leaving 64% from other drivers, and the industrial outlook is more important for growth. In the US, AI represents 75%+ of incremental electricity demand through 2030e.

Exhibit 38: We estimate data center powering requirements nearly doubling into 2030



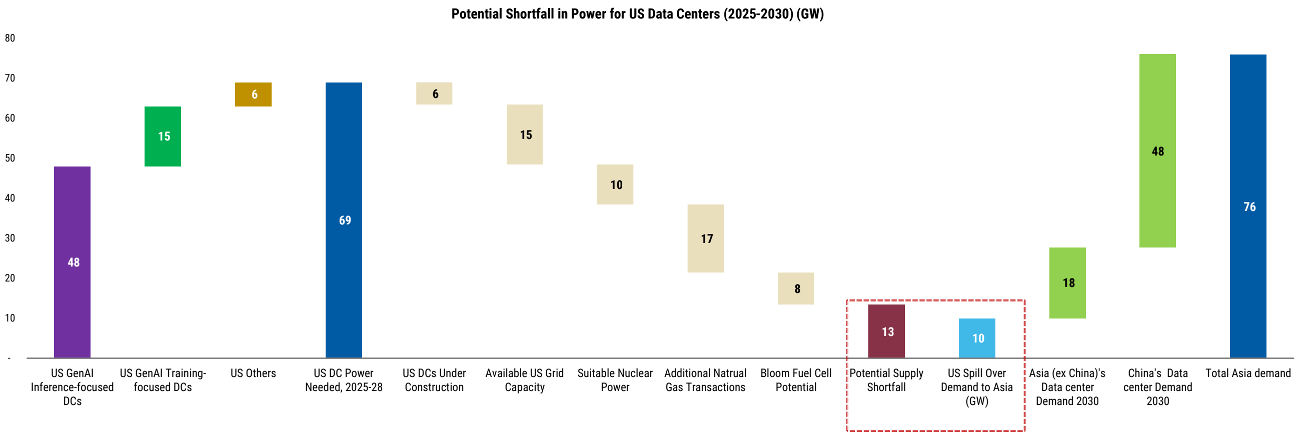
Source: Morgan Stanley Research estimates

US and the Spillover Effect to Asia

Data centers will drive US power demand in the near term, making up 75%+ of incremental load growth through 2030e. Leveraging the work of Morgan Stanley analyst teams around the world, we estimate US GenAI power demand will grow at a ~125% CAGR from 2023-28, with overall US data center power demand growing at a ~30% CAGR in the same period. With the substantial amount of load waiting to connect, we see a few solutions that could help meet part of the demand in the interim. After accommodating total power demand from data centers with non-grid-connected solutions, such as fuel cells and small-scale gas generation, and factoring in potential cryptocurrency mine conversions, we see data center demand growing to ~824,000 GWh by 2030 and ~1,050,000 GWh by 2035, or a ~13% CAGR over the next 10 years.

US power supply chain constraints also help more AI capacity in Asia: We estimate that a 13GW potential shortfall in power for US data centers by 2030 will have significant spillover effects to Malaysia and the rest of Asia (Exhibit 39). Our US power team estimates 69GW of incremental US GenAI-focused DC demand with ~48GW of inference-focused DCs implying 15GW of training-focused DCs. With US power grids near capacity, we believe at least 10GW of training workload could be offshored to Asia by end of the decade to unlock the "Time to Power" value from the US$1trillion GenAI economy. We estimate incremental power demand will be powered by gas as the region remains committed to transition away from coal-based generation and ramp up of nuclear capacity proceeds gradually.

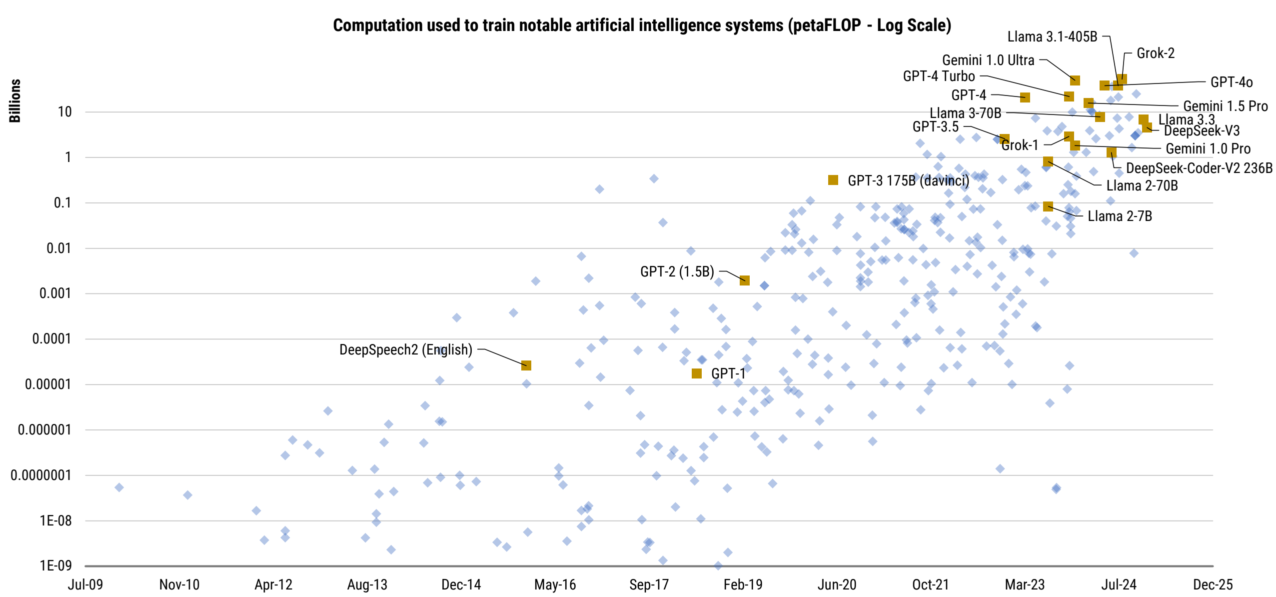
Exhibit 39: We estimate ~13GW of potential shortfall in power for US DCs factoring suitable nuclear and fuel cell powering potential



Source: Company Data, Morgan Stanley Research estimates

More efficient models will drive increased AI adoption across more use cases – Recent advances in LLM by DeepSeek R1 have demonstrated that cutting-edge AI capabilities can be achieved with significantly less hardware than other iterations and have defied conventional expectations of computing power requirements. We believe if the adoption curve inflects (as tech companies accelerate investments), we think our long-term growth estimate of 4%+ power demand remains intact. **NextGen LLM models will require 10x compute** of current commercial models. GPT4 required 10x more compute than GPT3, which required 10x more compute than GPT2. We expect each evolution of LLMs to require more compute capacity with efficiency gains on training and inference only increasing the time to market without significant reductions in absolute power demand requirements in the long run.

Exhibit 40: Evolution of AI training compute requirements shows a ~10x increase in compute for every generation of LLM



Source: Epoch, OurWorldInData, Morgan Stanley Research

Powering AI: Nuclear, energy storage and gas is not an either/or

Some investors have been taking a nuclear or gas approach – but in our view this should really be a nuclear, energy storage and gas approach when it comes to powering AI. We believe natural gas will be the primary near-term solution for powering AI data centers through 2030 due to its speed to market, reliability and flexibility, while nuclear power represents a longer-term clean energy solution that will likely gradually increase in importance as new facilities come online. The two energy sources will likely work in complementary roles, with gas addressing immediate power needs and nuclear providing sustainable baseload power over the longer term.

Natural Gas Solves the Powering AI Trinity: Time to Power, Safety and Reliability: While nuclear power remains the ultimate source of clean and reliable base load, the time required to setup a new nuclear power plant remains 8-10 years with significant regulatory hurdles. This is while demand for data centers is ever present today and hyperscalers are willing to pay 20-30% premiums for immediate power supply connection. Gas power plants require less permitting and it is a proven, well-accepted power generation technology, which solves speed to market, safety, and reliability concerns, in our view.

We estimate ~46GW of nuclear capacity added globally through 2030 with most capacity adds coming beyond 2030. Under our base case, global new nuclear capacity by 2050 will be 586.8GW, up 53% from our base case last year. Asia, especially India and China, will still be the centre of growth based on the current pipeline. Compared to last year, we raise the estimated capacity for China, India and the US. Both India and the US have significant upside potential, based on the latest government targets. Our base case assumes only 50% of the US and Indian targets to be met by 2050, as we remain conservative on the pace of large-scale build-out, and small modular reactors (SMRs) are still likely a next-decade technology. Elsewhere, we have been surprised by the capacity growth in CEEMEA, which could benefit Korea/Japan in this multipolar world. Based on the current pipeline under construction, planned or proposed, CEEMEA is the second biggest market for nuclear capacity, behind China. **Based on these capacity projections, capital investment will be around US$2.2 trillion**, up from the US$1.5 trillion we projected last year, mainly driven by higher projections of US and Indian capacity. Overall, our projections tend to be more conservative than the International Energy Agency (IEA) and International Atomic Energy Agency (IAEA) across most scenarios.

> *"Data center and artificial intelligence* booms, along with additional coal retirements, expected to drive a further ~10 Bcf/d of incremental natural gas *demand by 2030", EQT Corporation, 24 March, 2025*

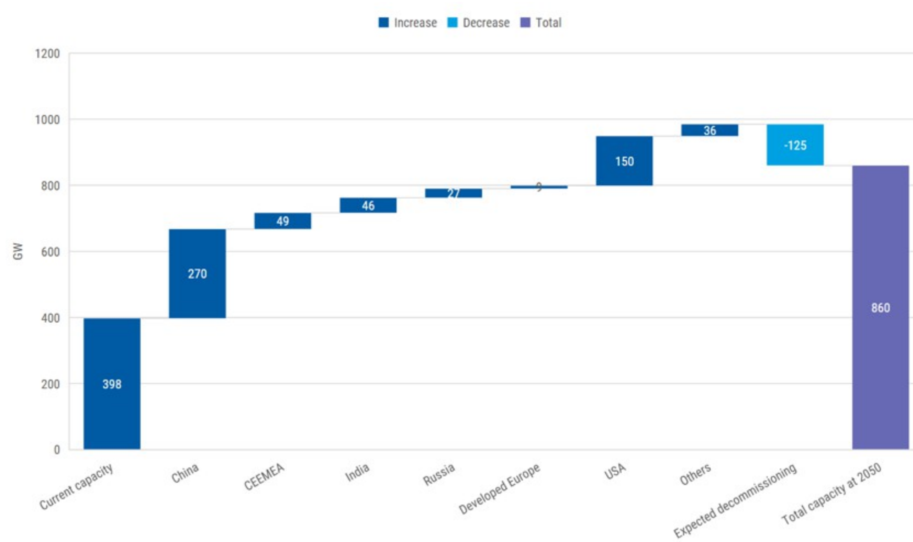
Exhibit 41: Nuclear vs. gas – it's not either/or when it comes to powering AI

Factor	Nuclear Power (Existing, Restarts, Life Extensions, SMRs)	Natural Gas
Time to power	- New large reactor: could be more than 10 years - multi-year licensing and construction with potential project delay risks - However, life extensions and restarts are much faster, and the modular nature of SMRs targets much shorter cycles	Permitting construction cycles of a combined-cycle gas turbines (CCGT) can be <3 years
Upfront capital requirements	- New large reactor: Very high capex financing requirements with potential for cost and schedule overruns. Depending on region, the upfront cost can be US$2800/kW-US$6600/kW - SMRs has much lower upfront costs compared to large reactors owing to their smaller capacity, although cost per kW could be higher (~US$8,000/kW for NOAK facility)	Much lower compared to nuclear at US$560/kW - US$1,000/kW
Fuel, carbon, operating and maintenance costs	- Fuel cost just a minor share of overall cost given long lifespan, and typically once a reactor is loaded with uranium fuel, costs are set for a long period; O&M cost could be expensive depending on plant age and regulatory requirements - Once capex is recovered, marginal output is extremely cheap, making lifetime extension very cost-effective (LCOE of lifetime extension is lowest)	- Natural gas market is more volatile and the fuel component accounts for ~90% of overall cost; we could also see greater emission compliance costs ahead
Carbon emissions/ environmental concerns	-Zero-emission energy source at point of use. -However, from a lifecycle perspective, there are emissions associated in the plant construction phrase. Also, nuclear waste management may pose long-term concerns	Cleaner than coal but emits more carbon than nuclear and renewables; may require additional measures (offsets or CCS) if hyperscalers are to meet sustainability goals
Scalability and capacity	SMRs produce 0.2-0.3GW vs. large-scale reactors at ~1GW. Co-location reduces grid connection burden. Nuclear also has extremely high power density	Also scalable but typically smaller installations (10-100MW). However, air pollution concerns (NOx) may cap cluster size
Technology trajectory	- While large-scale reactors may not significantly improve in cost, SMR cost curve could improve on greater volumes in future - However, reliability and safety of large-scale reactors are improving and there are also other alternatives (fusion - speculative for now but backed by Microsoft; some use cases of Thorium in China and India)	Efficiency gains more incremental; CCS retrofit remains costly and hydrogen pathways remain uncertain

Source: Morgan Stanley Research

The nuclear premium is largely a constraint to the US: In the US, nuclear power commands a premium of roughly US$30-US$50/MWh in recent corporate Power Purchase Agreements (PPAs), reflecting its reliability, zero-carbon profile, and limited supply. Deals such as Talen-Amazon, Constellation-Microsoft, Constellation-GSA, Constellation-Meta, and NextEra-Google illustrate this trend, with contract prices typically in the US$80-US$100/MWh range – well above market rates - driven by attributes like behind-the-meter access (for Talen-Amazon), capacity value, and long-term supply certainty. However, this premium pricing remains largely unique to the US, where corporates are competing for firm, carbon-free energy to power data centers and AI loads. In contrast, China is prioritizing renewables for data center supply, Europe has yet to see premium nuclear PPAs (though the Nordics and France could lead future developments), and ASEAN markets continue to rely on cheaper fossil fuels, particularly gas and coal, to meet rapidly growing power demand until nuclear capacity emerges later in the 2030s.

Exhibit 42: Global nuclear capacity under our base case – nuclear renaissance scenario



Source: Morgan Stanley Research estimates

AI Power Demand Growth, Tiered Price Policy, and the Role of Energy Storage

Stephen Byrd

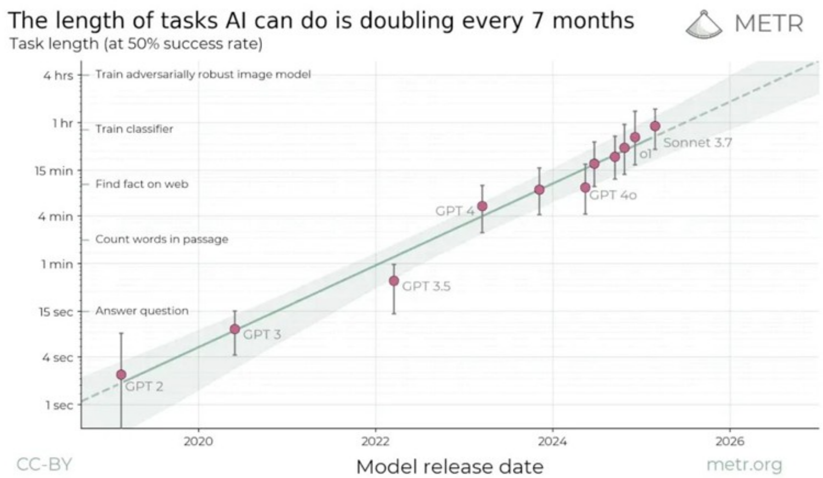
Key takeaways: (1) we expect AI-driven power demand to surprise to the upside over time, as it has consistently done over the past 2 years, driven by the non-linear rate of improvement in AI capabilities, **(2)** with this rapid growth in data center power demand, we believe there will be increasing political concerns voiced regarding potential upward price pressure on utility bills for all customers, and **(3)** these concerns will in turn result in greater deployment of energy storage than appreciated, as well as the development of special (higher) power rates for data center customers in order to protect other customers.

Upside to Data Center Growth: The Non-Linear Rate of AI Improvement

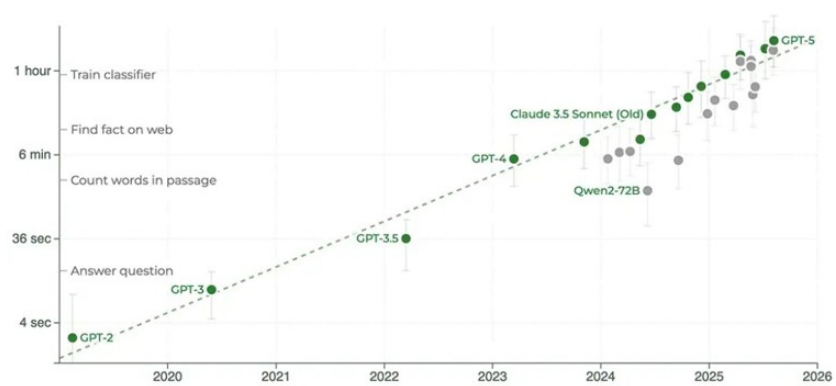
We believe in 1H26, we may witness a catalyst that is not well appreciated in terms of its magnitude and nature: the results of several US LLM developers applying ~10x the compute to the training of their frontier models. To underscore the potential significance of this catalyst, we note a recent interview with Elon Musk, in which he stated his view that applying 10x compute to LLM training will double the model's "intelligence". While many other LLM developers broadly agree with Mr Musk (and a recent research report from a team at Meta suggests low probability of an upcoming scaling limit), there are others who are skeptical and believe there may be limits to improving the intelligence, creativity and problem-solving capabilities of the frontier models. We broadly categorize these concerns as falling within the concept of a "scaling wall," in which greater levels of compute applied to LLM training achieve rapidly diminishing (and disappointing) results. The stock and asset valuation implications of the next phase of LLM training are much broader and deeper than appreciated. To give you a sense of the magnitude of computational power involved, a 1,000 megawatt data center comprised of Blackwell GPUs would have >5,000 exaFLOPs (one quintillion floating point operations per second) of computational power - contrast this to a US government supercomputer known as "Frontier," which has just over 1 exaFLOPs of computational power.

Julian Schrittwieser's Arguments in Favor of Non-Linear Improvement
In a recent blog post from Julian Schrittwieser, co-first author on AlphaGo, AlphaZero and MuZero, Mr Schrittwieser describes his view with respect to the continuing non-linear rate of LLM capability: improvements:

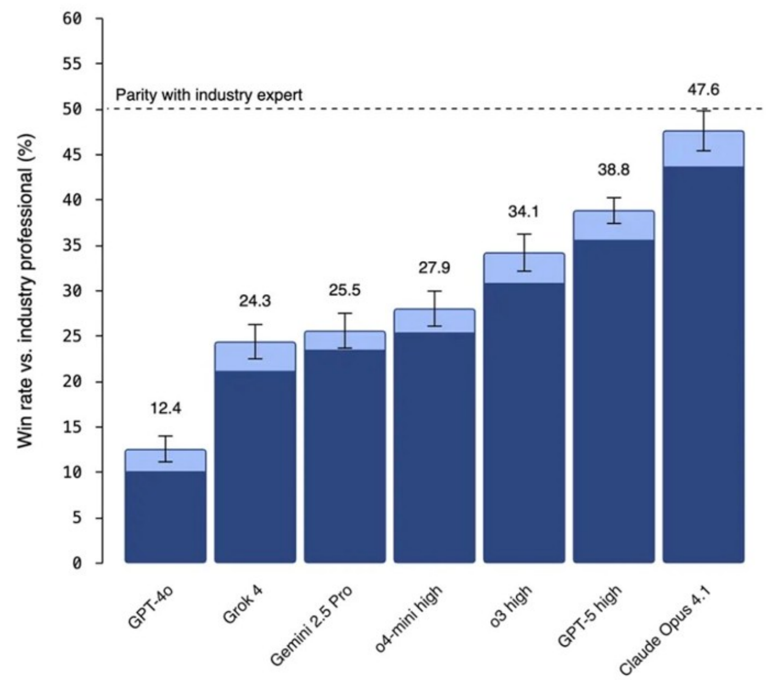
"Accurately evaluating AI progress is hard, and commonly requires a combination of both AI expertise and subject matter understanding. Fortunately, there are entire organizations like METR whose sole purpose is to study AI capabilities! We can turn to their recent study 'Measuring AI Ability to Complete Long Tasks', which measures the length of software engineering tasks models can autonomously perform:



"We can observe a clear exponential trend, with Sonnet 3.7 achieving the best performance by completing tasks up to an hour in length at 50% success rate. However, at this point Sonnet 3.7 is 7 months old, coincidentally the same as the doubling rate claimed by METR in their study. Can we use this to verify if METR's findings hold up? Yes! In fact, METR themselves keep an up-to-date plot on their study website:



"We can see the addition of recent models such as Grok 4, Opus 4.1, and GPT-5 at the top right of the graph. Not only did the prediction hold up, these recent models are actually slightly above trend, now performing tasks of more than 2 hours! A reasonable objection might be that we can't generalize from performance on software engineering tasks to the wider economy - after all, these are the tasks engineers at AI labs are bound to be most familiar with, creating some overfitting to the test set, so to speak. Fortunately, we can turn to a different study, the recent GDPval by OpenAI - measuring model performance in 44 (!) occupations across 9 industries…. Again we can observe a similar trend, with the latest GPT-5 already astonishingly close to human performance…. Fortunately for us, OpenAI also included other models in the evaluation, and we can see that Claude Opus 4.1 (released earlier than GPT-5) performs significantly better - ahead of the trend from the previous graph, and already almost matching industry expert (!) performance:



"Given consistent trends of exponential performance improvements over many years and across many industries, it would be extremely surprising if these improvements suddenly stopped. Instead, ***even a relatively conservative extrapolation of these trends suggests that 2026 will be a pivotal year for the widespread integration of AI into the economy: Models will be able to autonomously work for full days (8 working hours) by mid-2026; At least one model will match the performance of human experts across many industries before the end of 2026; By the end of 2027, models will frequently outperform experts on many tasks.*** *It may sound overly simplistic, but making predictions by extrapolating straight lines on graphs is likely to give you a better model of the future than most "experts" - even better than most actual domain experts!"*

While there are reasons to be bullish on the resulting capabilities from the frontier LLMs in 2026, such a result is far from a foregone conclusion. For example, Andrew Trask, a research scientist at Google DeepMind, recently described Richard Sutton and "the Bitter Lesson's Bitter Lesson." The concept of the Bitter Lesson, put forth by Richard Sutton, one of the pioneers in the development of Reinforcement Learning and winner of the 2024 Turing Award, is that "babies and animals don't learn through imitation, so state-of-the-art LLMs are pursuing the wrong path by imitating humans through next-token prediction… Sutton's position effectively suggests we should re-run evolution from scratch rather than inherit knowledge from our evolutionary and cultural history." In a recent interview with Dwarkesh Patel, he summarized Dr. Sutton's points: "[H]e thinks LLMs are a dead end. After interviewing him, my steel man of Richard's position is this: LLMs aren't capable of learning on-the-job, so no matter how much we scale, we'll need some new architecture to enable continual learning. And once we have it, we won't need a special training phase - the agent will just learn on-the-fly, like all humans, and indeed, like all animals. This new paradigm will render our current approach with LLMs obsolete." Andrew Trask summarizes this dynamic:

"Sutton's position effectively suggests we should re-run evolution from scratch rather than inherit knowledge from our evolutionary and cultural history. This encounters the Bitter Lesson's Bitter Lesson: if we discard everything humanity and nature have learned and attempt to re-learn policies from first principles, we must regenerate a comparable set of samples that evolution used…potentially greater than 10^50 operations when accounting for neural activity across every organism that contributed to our evolutionary trajectory. For reference, current AI models use around 10^26 operations."

Mr. Trask adds his own thoughts regarding why the current approach to training LLMs is likely not a dead end:

"Sutton's framework illuminates a fundamental division in AI research between experiential learning (direct environmental interaction) and inherited learning (accumulated knowledge transmission). This distinction reveals something essential about intelligence itself…. To solve the problem of gathering lived experience across time and space, humans developed information technology. We began with language 250,000 years ago, creating two revolutionary capabilities: broadcasting (transmitting learned knowledge to others) and broad listening (synthesizing information from multiple sources into superior world models). And since that time, we've advanced information technology by increasing the scale at which we can broadcast and broad listen. This is wholly different from re-learning through experiential learning. Modern physicists don't re-derive calculus from first principles…they inherit humanity's mathematical frameworks and extend them further. Nevertheless, Sutton has a point. LLMs have exhausted the internet. So what's next? Have LLMs run their course, requiring us to pivot to experiential learning? Not necessarily. Current LLMs demonstrate broad listening at unprecedented scale, but they access only a fraction of humanity's accumulated knowledge. Leading AI models are trained on datasets measuring in hundreds of terabytes…for reference, you could store GPT-4's training data using a few dozen consumer hard drives from Walmart. Meanwhile, the world has digitized an estimated 180 zettabytes of data, over a million times more than what trained today's leading models. The vast majority of human knowledge remains locked in private databases, medical records, proprietary research, and institutional knowledge. Consider the scale: Current LLM training data: ~100-200 terabytes; All digitized human knowledge: ~180 zettabytes (180,000,000,000,000 terabytes); Ratio: Over 1,000,000,000x more data exists than we currently use...The challenge isn't data scarcity…it's enabling knowledge transfer while preserving control and ownership (e.g. privacy, safety, security, copyright, etc.)….

"The technical and policy frameworks for implementing such systems are rapidly developing. The convergence of privacy-enhancing technologies, attribution-based AI architectures, and new approaches to data governance creates unprecedented opportunities to build AI systems that truly leverage the computational advantages of inherited learning at civilizational scale."

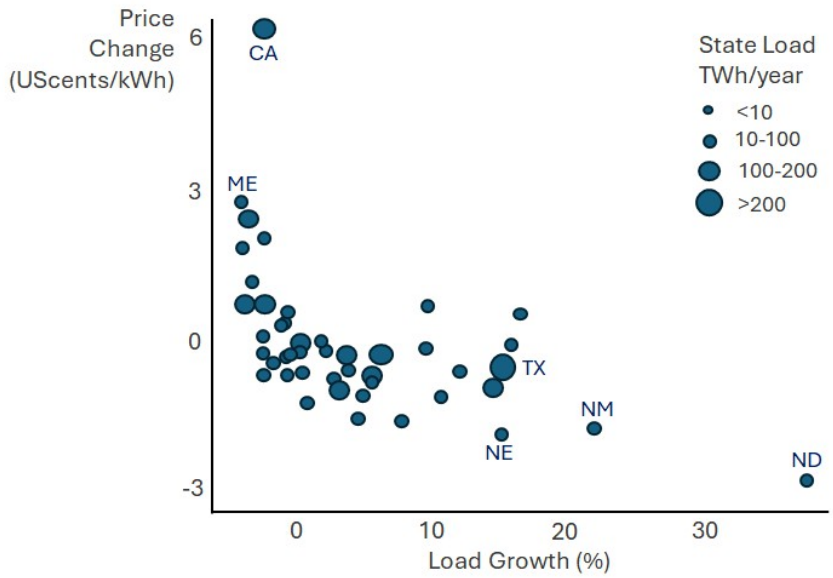
Recent Analysis of Potential Scaling Limits
A recent paper from a team at Meta, Virginia Tech and Cerebras Systems published a paper entitled "Demystifying Synthetic Data in LLM Pre-training: A Systematic Study of Scaling Laws, Benefits, and Pitfalls." In this paper, the research team assess whether there are limits in improvements in LLMs as computational power, and synthetic data, used to train these models increases. Synthetic data is "text generated by pre-existing models or automated pipelines," and the research team notes that "synthetic data presents a compelling potential avenue for augmenting - or perhaps eventually replacing - traditional human-generated corpora during the foundational pre-training phase." Among the key findings from the team including takeaways that are relevant for the key question of whether greater compute and synthetic data usage for future LLM training will result in hitting a "Scaling Wall." In the parlance used by the researchers and others in the field of LLM development, the issue presented is the risk of "model collapse," which is the theory that LLM performance will deteriorate due to "the effect of iterative training on self-generated (or mixed) data." That is, the concern would be that synthetic data (data generated during LLM development - as opposed to data based on human activity, such as research and writing), which can comprise an increasingly large volume of training data for extremely large LLMs, would be of diminishing value (or potentially be outright harmful) for LLM capability improvement. **A key takeaway from this research team: "when using rephrased synthetic data in pre-training contemporary LMs, we do not see patterns of degradation in performance in foreseeable scales, and pre-training on rephrased synthetic data mixed with natural data can lead to significant speed-up in reducing validation loss."**

This is an encouraging finding in the context of attempting to forecast what a ~10x increase in computational power for LLM training in late 2025/early 2026 may yield.

Energy Storage and AI: Significant Upside to Demand Estimates

We believe the demand for energy storage globally may surprise to the upside due to AI-driven considerations, namely: **(1)** the political objective to avoid putting upward pressure on power prices for other customers as a result of data center power demand, and **(2)** power grid benefits from shifting "peak load," reducing power demand volatility, and better utilizing existing grid resources.

Regarding the impact to power prices from data center growth, the data is somewhat scant, but the politics are decidedly negative. The Brattle Group recently published a study of US power prices, and one of the findings was that there does not appear to be a relationship between power price growth and power demand (load) growth:



On the other hand, there are other expert analyses suggesting a link between customer utility bill growth and data center growth. For example, the Independent Market Monitor (IMM) for the PJM Independent System Operator (ISO), one of the largest US power markets, issued a report in which the IMM linked high capacity prices to data center growth: "The basic conclusion of this analysis is that data center load growth is the primary reason for recent and expected market conditions, including total forecast load growth, the tight supply and demand balance, and high prices...the inclusion of forecast data center load increased total [capacity] revenues by [US$7.3 billion] or 82.1 percent."

The politics surrounding higher power prices, and the potential linkages to data center growth have taken center stage in the US, and in many key data center markets globally. For example, on October 28, 2025, 20 House Democrats sent a letter to the Federal Energy Regulatory Commission (FERC), among other recipients, requesting a study of the impact to power prices from rapid data center growth. An excerpt from the letter:

"Data centers play a vital role in advancing U.S. innovation, competitiveness, and security. However, we are concerned that energy costs associated with data center development and power consumption are increasingly being passed on to everyday Americans and small businesses, undermining energy affordability for consumers nationwide."

One approach to mitigating the potential political pushback to data center growth would be for data center developers to incorporate multi-hour energy storage into their data center designs. The advantage of this approach: (1) ability to show policymakers that, during peak power demand periods, the data center will not draw any power from the grid, and (2) ability to provide flexible load that can help grid operators mitigate broader grid instability issues caused by any number of factors (such as weather extremes). The volume of energy storage demand from data centers taking this approach could be significant. For example, if 25% of our projected data center growth through 2028 includes four hours of energy storage, the resulting demand would be 126 GWh through 2028; as a frame of reference, this would be >60% of global BESS storage growth in 2024.

Surprise #1: Grid Constraints: Everywhere, All at Once

"Here's the problem: Investments in the right infrastructure are not keeping up. That ratio (of investments in renewable generation and grid infrastructure) should be one to one." - *António Guterres, Secretary-General of the United Nations*

While grid investments globally are stepping up in all regions with US$400bn spent in 2024 alone, they have not grown commensurate to the deployment of renewable generation capacity and would require a significant step up in the coming years, with the IEA estimating US$600bn annually required by 2030 in response to higher power demand and a more distributed generation profile from renewables. We are already seeing the effects of insufficient grid investments with renewable curtailments reaching ~10% in some regions, while negative power price occurrences have reached ~20% of the time in California and South Australia (Exhibit 9). We think this will take time given grid equipment lead times are extending through 2028. Higher curtailments for renewables are making gas-fired generation, which is quicker to ramp up and down, key for global power systems to run without tripping. We think this supports earnings growth for grid operators, a longer upcycle for grid equipment manufacturers and conventional power generators.

Rising Renewable curtailments = More Base load Power and Batteries

Curtailment of renewable power is rising globally, especially in places where wind/solar growth has outpaced transmission, storage and flexible demand. Hotspots include Western China, California and the US Midwest, Europe, parts of Australia, northern Chile, Brazil's Northeast and is starting to show up in India as well. Midday oversupply and grid congestion is largely to blame. In California, curtailed wind and solar reached ~3.42 TWh in 2024, reflecting congestion and system-wide oversupply. Germany shows the same strain: ~19 TWh of renewable electricity was curtailed in 2023, i.e. ~4% of national generation, due to grid bottlenecks requiring re-dispatch.

- **In China:** Renewable curtailments have increased ~50% in some provinces this year, as renewable resources were strong and demand slowed marginally. 1H25 curtailment rose nationally: solar ~6.6% (vs 3.9% a year earlier) and wind ~5.7% (vs 3%), with high rates in Tibet and Qinghai. While grid investment has increased substantially in recent years, we expect higher curtailments to persist in the medium term as grid upgrades are ongoing.
- **In India:** India's government is looking to invest US$27bn in transmission associated with 500GW of renewable energy to unlock stranded renewable capacity and enable dynamic corridor sharing between states. Congestion in power lines due to some new plants coming into operation ahead of schedule and delayed transmission projects have also forced power output curbs. The National Solar Energy Federation of India (NSEFI) reports that solar power producers in Rajasthan, the top green power producing state, faced prolonged and frequent

curtailments, which had risen to 48% of output during peak generation hours. The producers have lost more than US$26mn in revenue since April due to the curbs. The government is looking to revoke projects that have not be able to get sale contracts due to grid constraints. Also there is potential for increased transmission charges for renewables when supplying between states in India (previously subsidized).

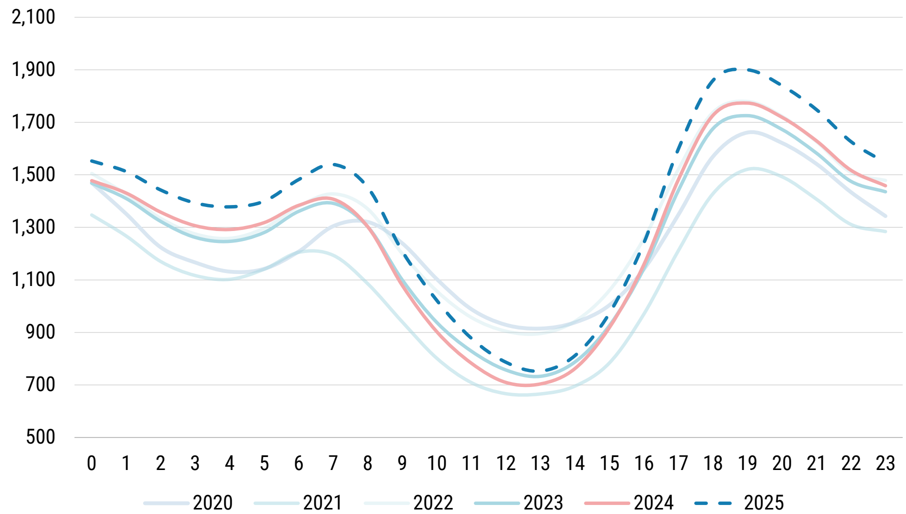
- **In US:** California reported 3.4 TWh curtailed in 2024 (up 29% YoY), ~93% solar - mainly spring midday and during congestion. CAISO's 2024-25 Transmission Plan funds major upgrades to move/absorb surplus.
- **In Europe:** In the UK for FY 2024/25, wind was curtailed ~13% of the time it could have run, driving high balancing costs; the national operator (now NESO) cites Scottish-southbound constraints and planned outages. In Germany, the regulator reports PV curtailment of ~1,389 GWh in 2024 - up ~97% YoY - while overall RES utilisation still exceeded 96%. Causes: rapid PV growth and sunny 2024 summer.

Frequency of negative power prices rising globally

According to IEA, most of Europe experiences negative power prices ~8% of the time in 2025, while in California and South Australia negative power prices are observed close to ~20% (Exhibit 9). Regions with significant wind and solar generation often see excess electricity during sunny or windy periods, which cannot be absorbed by demand or cannot be transported due to insufficient transmission capacity. This has led to increasing curtailments of power dispatch in recent years.

In Australia, battery and energy storage saturation is still far away, we estimate ~8GW 2-hours of battery under construction, vs. a ~9.5GW NEM daily duck curve, and ~3GWpa rooftop solar installation, which would drive annual increases in the duck curve, and more frequent negative prices (NSW YTD 10%, up from 5% in the pcp, Vic 18%, up from 15% in the pcp). The Australian Government has announced a new tariff with ≥3 hours free power, e.g., 11am-2pm, for smart meter households in NSW/Qld/SA from FY27. All else equal, we estimate a bill saving to eligible households that take up the Solar Sharer Offer (SSO) of ~A$660/year (including GST). This would result in a total load shift of 1.5TWh across the NEM (equivalent to a 500MW 3-hour battery), which we think would be material in reducing duck curve impacts, however prior to mitigation, we estimate a plausible negative FY27 EBITDA impact to power producers AGL and ORG.

Exhibit 43: The South Australia Duck Curve (MW) is getting deeper

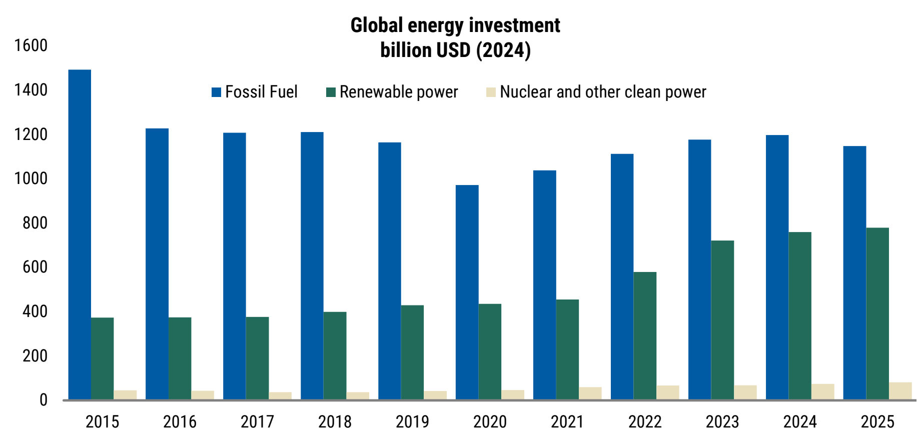


Source: Australian Energy Market Operator, Morgan Stanley Research. Shows average hourly demand. 2025 is for Jan-Oct.

Insufficient Baseload Investments Accelerate Grid Constraints

Global power investment has tilted heavily toward variable renewables, while comparatively little new firm "baseload" or flexible capacity has been added, a mismatch that's showing up as rising curtailment. In 2015, spending on clean power was roughly 2:1 versus unabated fossil; by 2024 it was about 10:1, with the IEA projecting solar alone to top US$500bn, and it warns this surge needs matching investments in flexibility and storage to avoid oversupply periods.

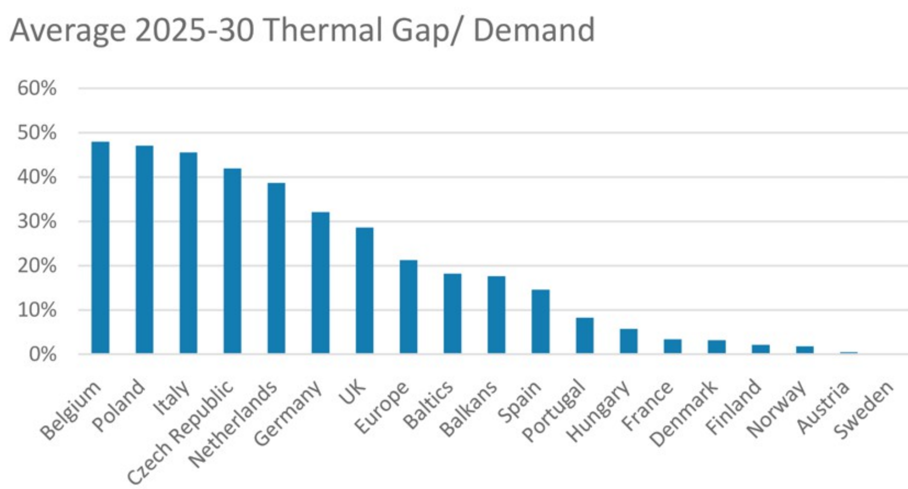
Exhibit 44: Global investments in renewables have slowed as grid constraints and energy security concerns weigh



Source: IEA, Morgan Stanley Research

The role of base load fossil fuel/nuclear power is more important than ever to stabilize the grid. More so given the expected round-the-clock power demand from data centers, and as the global electricity generation mix is reshaped with renewables and gas at the core of the transition in these markets (Exhibit 46). After several years of decline, investment in fossil fuel power is ticking up. The economics of a combination of gas + renewables remains highly competitive at ~ US$75/MWh, similar to the cost of generation using only coal, while offering a lower carbon footprint and the potential to drive opportunities for power generators with a mixed asset base to earn returns above the cost of capital in a backdrop of higher power demand. The rising global glut of LNG, as export facilities ramp up in the US and Middle East, could also lower the marginal cost to produce gas-based power and cheaper clean power equipment costs, which could further reduce system-wide cost of generation to ~US$70-75/MWh in Asia. We have already seen more gas-based generation capacity being announced in the US, Malaysia, Singapore, Philippines, Japan and Germany, and higher utilization rates for gas-fired power plants in India.

Exhibit 45: European power markets are getting tight with the baseload gap / demand highest in central/ northern areas

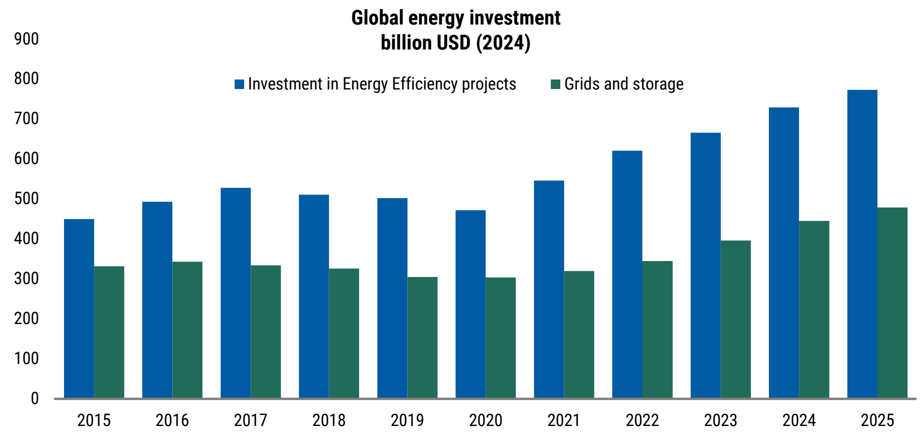


Source: ENTSOE, Morgan Stanley Research estimates

More Grid Investments Are Happening, but At a Slower Pace

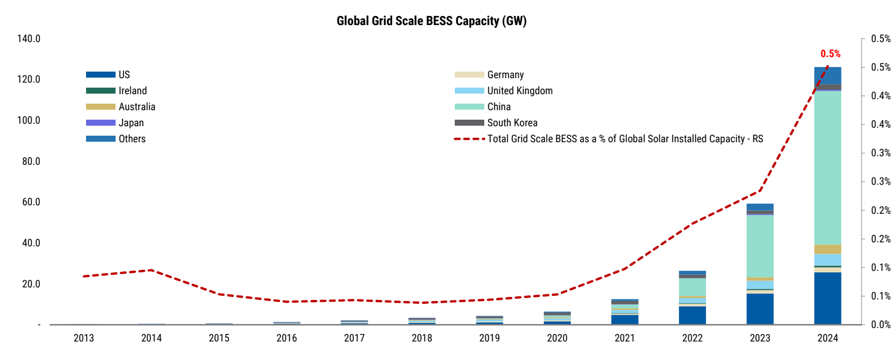
The case for grid investments and energy storage is gaining more traction in order to stabilise an electricity system with a higher intermittent and dispersed generation profile. Requirements by higher-voltage consumers, such as data centers, which have ability to pay for premium power, are also leading to a hardening of the grid. Long lead times compounded by years of under-investment have led to continued medium-term tightness in power grids with significant grid capex and growth opportunities for grid players, such as **National Grid, SSE, Sempra, and Tenaga.**

Exhibit 46: Global grid and energy efficiency investments have picked up in recent years with increasing investment commitments, but these will take time



Source: IEA, Morgan Stanley Research

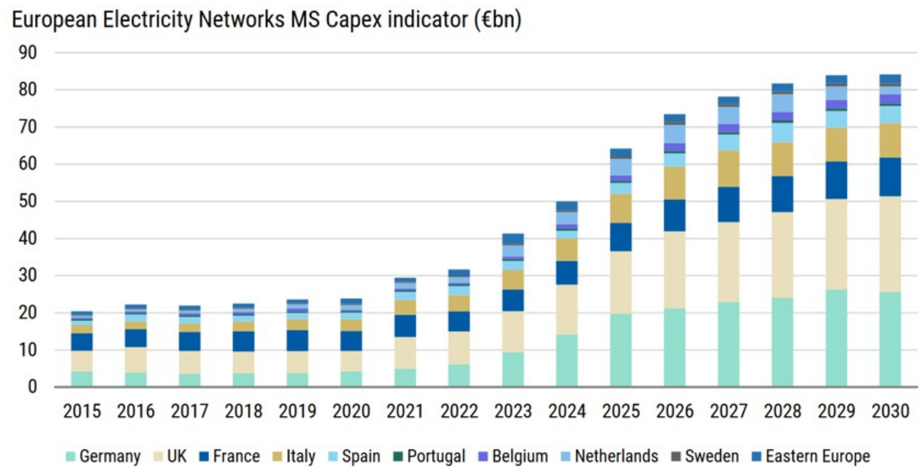
Exhibit 47: Global Battery Energy Storage Systems (BESS) have also been growing significantly to support more renewable capacity, however still remains <1% of global solar installed capacity



Source: Rystad, Morgan Stanley Research

Europe: The 'New Growth Era' for regulated electricity networks is a capex-driven theme, where we expect the coming decade to see investment levels 3.5-4 times higher than over the past decade (Exhibit 48). Furthermore, we note a greater weighting of sector capex towards Northern Europe, at 50% of the 2025-30 total, with the UK alone representing one-third of our sector forecast (implying a 150% increase in annual capex). We expect more modest growth in Southern Europe, with Spain and Italy representing a respective 4%/12% of sector capex growth, growing annual capex by 68%/122% out to 2030.

Exhibit 48: We expect significant growth in power network capex in Europe in coming years



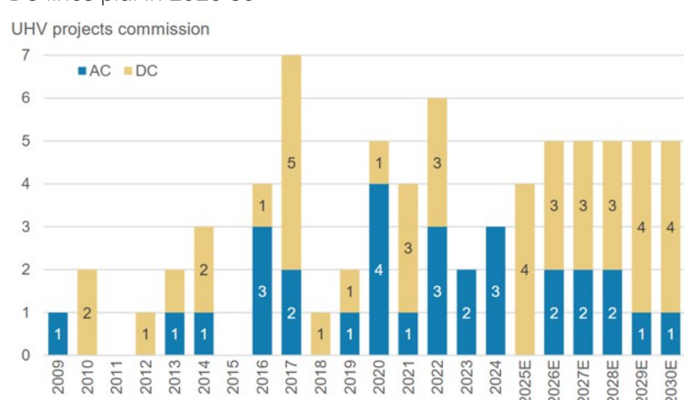
Source: Company data, Morgan Stanley Research estimates (2025-30)

China: The State Grid Corporation of China increased its annual expenditure by Rmb71.1bn to over Rmb600bn (US$83bn) in 2024. The additional spending will be used for: 1) construction of ultra-high voltage (UHV) DC and AC transmission projects; 2) enhancing county-level grid infrastructure and interconnection with regional grid networks; and 3) power grid digitalization upgrades. Historically, grid expenditure growth has been broadly in line with power demand growth, however, given a 6.5% power demand growth forecast for 2024 by the China Electricity Council (CEC), we think State Grid's >13% investment budget growth is a surprise (Exhibit 84). China's Southern Power Grid also recently announced a total investment of Rmb195.3bn (US$27bn) in 2024-27 for power grid equipment upgrades. We expect China to start construction of at least 3-4 UHV DC lines and 1-2 UHV AC lines each year over 2025-30.

Exhibit 49: China's remote desert and hydropower-rich regions are building renewable energy bases; nine renewable power bases in 14th FYP (2021-25)

Source: NEA, Morgan Stanley Research

Exhibit 50: UHV project commission pipeline: We expect China to maintain a commissioning pace of 1-2 UHV AC and 3-4 UHV DC lines p.a. in 2025-30



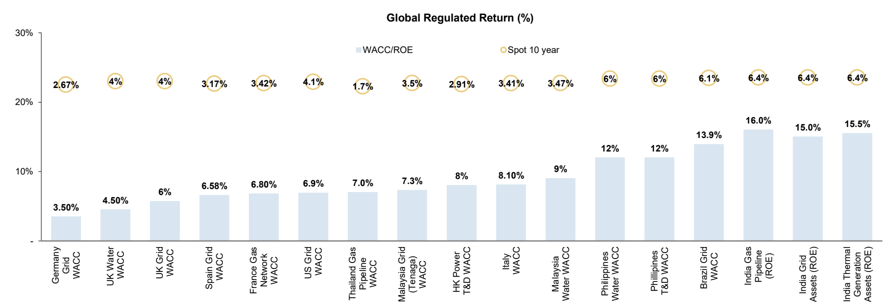
Source: Municipal governments, e = Morgan Stanley Research estimates

Malaysia: Our recent conversations with regulators, indicate increased long-term investment to harden the grid to make it "renewables" ready, along with the ability to adapt to bi-directional distributed power loads from rooftop solar. This should boost transmission and electricity distribution investments for much longer, at 1.5x the rate seen in the past 10 years, and raise tariffs for commercial users of power. Malaysia is also seeing its third inflection in foreign direct investment after a 15-year pause - this is key to boosting power demand growth to 4% sustainably, i.e., ~2x the past seven years' growth rates.

India: Powergrid transmits 45% of India's power. The company conservatively estimates it will incur capex of Rs3.07trn until F32, including interstate transmission capex of Rs2.7trn. For F26, it expects to incur capex of Rs280-300bn and commission transmission assets of ~Rs200bn.

Rising Regulated Returns: Incentivizing Grid Investment

Exhibit 51: How regulated returns compare globally



Source: Bloomberg, Company Data, Morgan Stanley Research

Across major markets, regulators are allowing higher or more stable returns for grid operators to accelerate the massive investment needed to modernize and expand electricity networks. Rising electrification, renewable integration, and resilience needs are driving record capital requirements, and regulators recognize that stronger financial incentives are essential to attract private capital amid higher interest rates and supply-chain pressures. As a result, authorities in the US, UK, Germany, Spain, and Australia have raised allowed returns or added targeted incentives - such as higher ROEs, capex premia, and performance-based adders - to ensure utilities can deliver critical grid upgrades on time while maintaining balance sheet strength.

- **US (Federal):** FERC has kept transmission ROEs methodologically anchored and predictable (most recently resetting MISO's base ROE to ~9.98%), while maintaining incentive tools (e.g., abandoned-plant recovery) that reduce downside risk on big lines - both of which help crowd in capital for expansion.
- **Germany:** The Bundesnetzagentur (Germany's regulator) raised the equity return for new investments via a capex mark-up from January 2024, explicitly to accelerate network build-out - an incremental uplift focused on future assets.
- **United Kingdom:** ASTI framework adds targeted allowances and delivery incentives for fast-tracked transmission projects, with ex-post adjustments and ODI mechanisms - effectively improving risk-adjusted returns for timely grid delivery.

- **Spain:** The CNMC has lifted the financial remuneration rate for electricity networks to the ~6.58% area for 2026-31 (from ~5.6%), explicitly to support higher grid investment needs - an example of the upward reset in continental Europe.
- **Australia:** Under the AER's 2022 Rate of Return Instrument, allowed returns are indexed to contemporary market data; recent determinations and updates show higher nominal allowances versus the ultra-low era, supporting larger five-year capex programs (e.g., 2024-29 decisions).

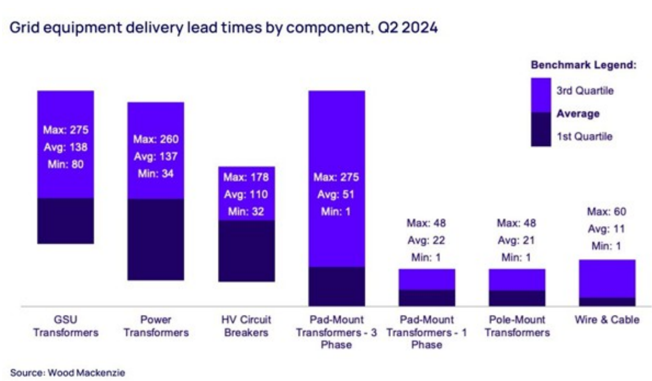
Grid equipment bottleneck tightens power markets

Despite the significant step up in grid investments over the past few years to harden power grids globally, equipment remains a key bottleneck. (Exhibit 52) Lead times on transformers are 2.5-4.5 years. Orders today are being booked for 2027-28 delivery. Manufacturers are adding transformer capacity ranging from 30-100%, but this is in phases to 2028, while Bloomberg New Energy Finance forecasts US transformer demand (units) to be 65% larger in 2027, compared to 2023, and we estimate network capex doubling in 2030 vs 2023. We believe the grid equipment bottleneck further tightens power markets and supports the demand for gas-based power generation and quick-to-market off-grid solutions for data centers.

Lead times on transformers remain high. Depending on transformer type, lead times increased from 40-80 weeks at the start of 2022 to 120 weeks at the end of 2023. However, company feedback signals that transformer lead-times may be even higher than this, e.g., at 2-3 years for Fortune Electric (not covered), with the European suppliers facing lead times that are higher still.

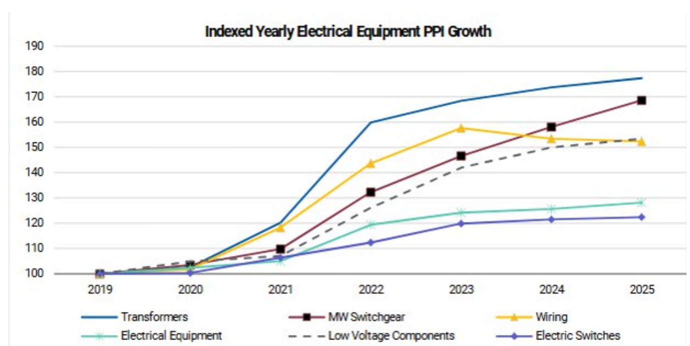
For more details on our previous work on grids, see our report: *Global Grid Equipment; Reaching a new peak (LINK).*

Exhibit 52: Grid equipment lead times have been rising significantly, and will likely remain a bottleneck in the near term while capacity is added



Source: Wood Mackenzie

Exhibit 53: Electrical equipment producer price inflation. Transformers and medium voltage switchgears have seen significant price inflation, but the rate of increases appears to have moderated.



Source: Datastream, Morgan Stanley Research

Grid equipment capacity additions take time, with manufacturers expected to expand by 300-400bp. Siemens Energy recently highlighted on its 4Q24 call that it is investing in its transformer capacity and cited expectations of a 30% increase in transformer production after these investments. GE Vernova cited doubling transformer capacity at its Stafford UK facility specifically. Hitachi is making substantial investments in Finland for a greenfield transformer plant (US$180m), and, on top of additional investments globally, this appears set to double its global transformer production capacity in the medium term. Finally, at its capital markets day, Fortune Electric highlighted increasing capacity by 30% per year in 2025, 2026 and 2027, but also that it is fully booked out to 2027. Smaller Asian players are also expanding production facility overseas. For example, JST Power Equipment (not covered) is ramping up a new factory in Poland to address the European market, while expanding its footprint in Mexico. To put these capacity increases into perspective, Bloomberg New Energy Finance forecasts point to demand for transformers being 65% higher in North America in 2027 vs 2023 levels. For the broader market, Siemens Energy and GE Vernova have highlighted the total grid equipment market growing at a 10% CAGR in 2022-30, with the market expected to be 75% larger in 2030 versus 2023 levels (Exhibit 54).

Exhibit 54: Global Power Transmission & Distribution Equipment Suppliers

	2024 Sales (EUR mn)	Product	Transformer, % of Sales	Geographic Mix
Europe				
Siemens Energy Grid Technologies*	9,280	Transformers Switchgear Converter towers HVDC (Onshore/Offshore) FACTS & Energy Storage Grid Stabilizations Grid Services & Digitalizations	30%	EMEA, 52%; US, 20%; APAC, 18%; Rest Americas 10%
US				
GE Vernova Electrification*	6,900	Transformers Switchgear Converter towers HVDC (Onshore/Offshore) Grid Services & Digitalizations	na	EMEA, 37%; US, 37%; APAC, 16%; Rest Americas 10%
Japan				
Hitachi Energy*	13,806 (Mse)	Transformer Switchgear HVDC (Onshore/Offshore) FACTS & Energy Storage Grid Solutions & Services	45-50%	Europe, 31%; Americas...; AMEA, 40%
China & Taiwan				
JST	961 (est)	Transformer Switchgear (MV/LV)	c.60%	Export 29% vs. Domestic 71%
TBEA	12,605 (est)	Power T&D (transformer and switchgear)(HV/MV) Polysilicon Cables Solar & Wind solutions	c.22%	Export 12% vs. Domestic 88%
Fortune Electric	5,612 (Mse)	Transformer Switchgear (HV/MV)	78%	Export 56% vs. Domestic 44%
South Korea				
HD Hyundai	2,243	Transformers Switchgear HV/LV Motors Generator Rotating Machinery (Marine)	na (Power c.60% of sales)	Europe, 8%; North America, 27%; South Korea, 34%; Rest Asia, 30%; RoW, 2%
Hyosung Heavy Industries	3,306	Transformers Switchgear Grid Solutions & Services Industrial Machinery (motors, generators, gears)	na	Europe, 5%; North America, 10%; South Korea, 68%; Rest of Asia, 15%; RoW, 3%

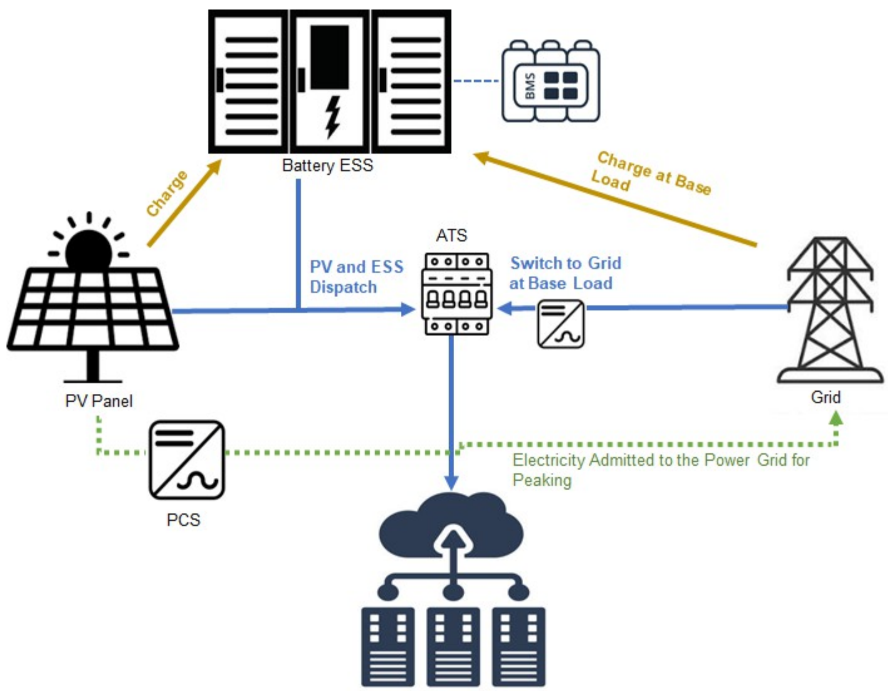
Source: Company data, est = Datastream, MSe = Morgan Stanley Research estimates, Morgan Stanley Research, * = division, Hitachi Energy using Mar-25 FY MSe

Will 2026 see the start of ESS in data centers?

We believe the shortage of gas turbines may provide Energy Storage Systems (ESS) with an opportunity to offer power solutions for data centers next year, particularly where there are grid capacity constraints. We see India, US and China, apart from Europe, seeing significant growth in energy storage demand by data centers and a regulatory push to improve grid stability. China should see 20% CAGR in ESS demand through 2030, while the economics for ESS could compete with gas+solar.

In the past seven years, CATL's ESS products have provided reliable and safe ESS at utility scale around the world. If US data centers were to deploy ESS as part of their power solutions, we believe CATL could become the dominant vendor, given this track record.

Exhibit 55: How ESS works to power data centers

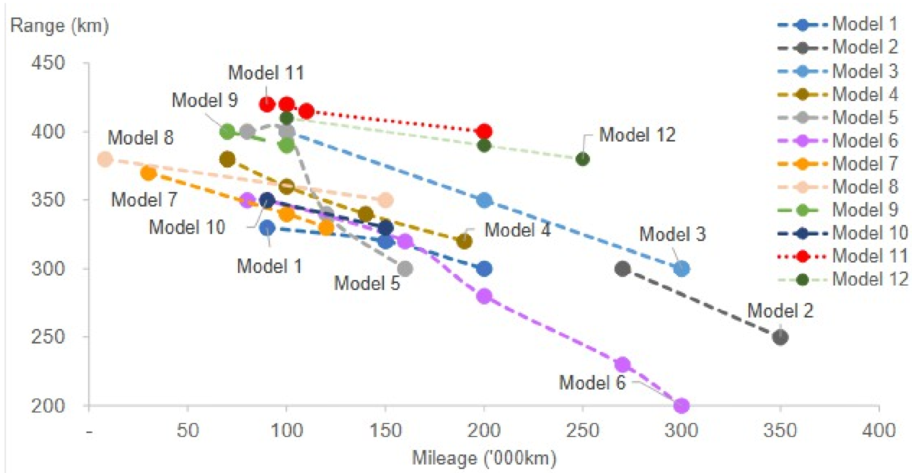


Source: Morgan Stanley Research

Why can CATL's ESS provide better economics than peers? In commercial energy storage markets, we believe dollars per cycle is a more important metric than dollars per kWh, as dollars per cycle throughout a battery's lifespan determines its economic efficiency. Degradation control is crucial to making a competitive dollar-per-cycle product. As a battery degrades, its power fades along with energy capacity. Faster energy degradation will lead to shorter lifecycles and inferior economics. For instance, 30% energy degradation post 1,000 cycles in vehicles means range decreases roughly 30% for e-trucks and e-buses, and revenue will decrease roughly 30% for ESS as well.

We conducted a 100-sample survey covering 12 EV models using data from shared mobility apps in China's four tier-1 cities. Our survey shows battery degradation varies from model to model, indicating different capabilities in battery interphase optimization and lithium replenishment. In 2B markets, battery degradation will have a negative impact on economics of operation. Our survey also shows there is a tension between energy density and degradation – with higher energy density causing faster degradation, requiring higher levels of lithium replenishment. Degradation control capabilities will differentiate products and their pricing, in our view.

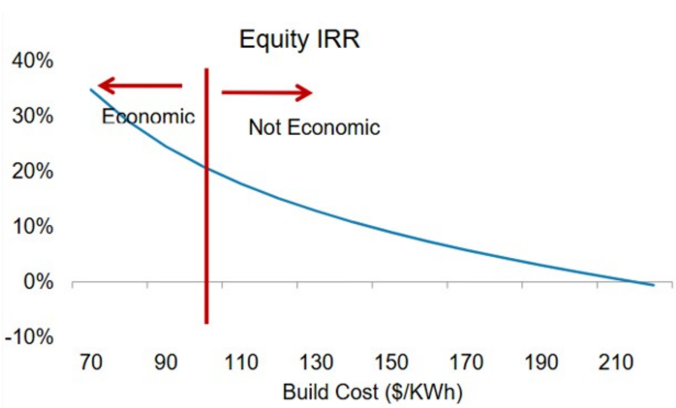
Exhibit 56: Battery Degradation: 100-sample battery performance survey from shared mobility - Model 11 and Model 12 using CATL's battery see significantly slower degradation than others



Source: Morgan Stanley Research

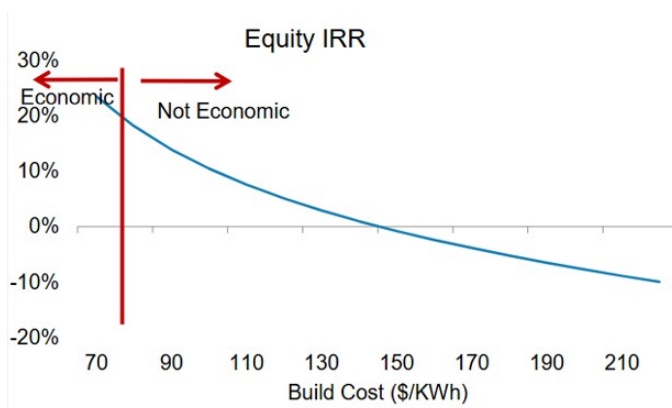
ESS economics enhanced by degradation control capability. In China, we assume revenue is mostly generated from on/off peak power price arbitrage opportunities under the renewable market trading scheme. Given a 20% required equity IRR, a project needs a build cost below US$75/kWh under fast degradation, vs US$105/Wh under slow degradation. Assuming a US$100/kWh build cost, unlevered IRR would be 12.6% under slow degradation vs. just 7.1% under fast degradation.

Exhibit 57: China's ESS equity IRR under slow degradation case



Source: Morgan Stanley Research

Exhibit 58: China's ESS equity IRR under fast degradation case



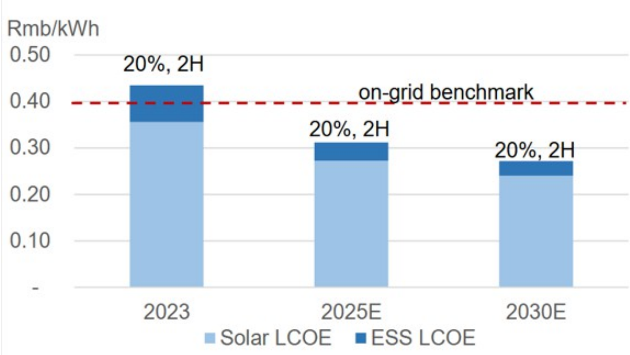
Source: Morgan Stanley Research

A decade-long supercycle for ESS deployment in China

We estimate that China is likely to require 1.54TWh of cumulative ESS development by 2030 and 3.82TWh by 2035. This implies a 21% CAGR in annual incremental development over the next five years, and a 14% CAGR in a decade.

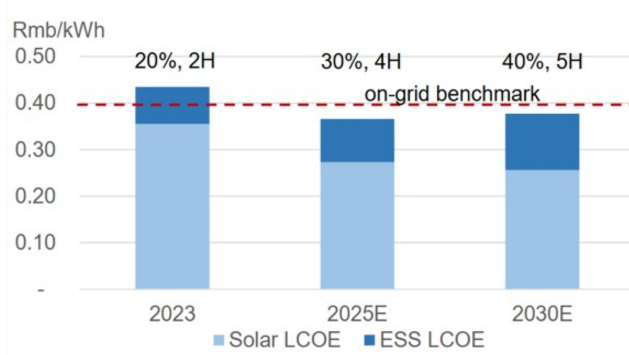
Economics continue to improve. China's utility-scale ESS LCOE (energy storage system, levelized cost of energy) has been significantly lowered over the past three years due to cost deflation, along with lower LCOE of solar power generation. From a solar plus ESS LCOE parity perspective (compared with on-grid benchmark), the current cost structure could allow 2x larger ESS demand at China's utility-scale compared with the level of ~100GWh in 2024, and 4x larger by 2030. In the calculations, we raise the ESS attach rate (the percentage of new solar installations) from 20% currently to 30% in 2025 and 40% in 2030; meanwhile, we also assume duration hours improve from 2 hours to 4 hours and 5 hours, respectively, to reach cost parity with on-grid benchmark.

Exhibit 59: LCOE of solar & ESS (20%, 2H) projects continues to fall



Source: Company data, Morgan Stanley Research (E) estimates

Exhibit 60: Future LCOE could allow ESS capacity (attach rate x duration hours) of the project to be 4x larger to reach cost parity with the on-grid benchmark by 2030



Source: Company data, Morgan Stanley Research (E) estimates

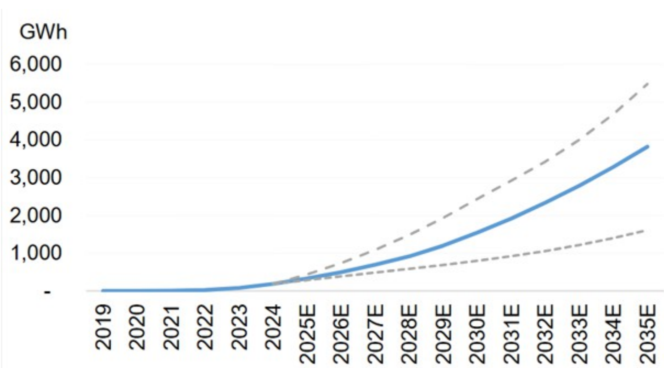
Real ESS demand finally unlocked by new renewable pricing scheme. Previously, real ESS demand hadn't been significantly unlocked, despite the lower LCOE, because there was no arbitrage for utility-scale ESS given zero price spread between base load and peak load on the power generation side in China. Utility-scale ESS has been largely deployed through mandates (renewables with ESS are allowed to be on-grid first) and a large amount of deployment has been under-utilized (using more and losing more) given zero arbitrage room and energy loss (85-90% energy efficiency). However, we think the renewable energy trading mechanism introduced in China early this year is a game-changer, as it will help to fully utilize ESS to profit arbitrage in the trading market (maybe also associated with capacity price, environmental benefits and ancillary service fee).

Our bull case: >50% probability of materializing, we estimate. We assume standalone ESS LCOE continues to drop thanks to technology iteration, reaching cost parity with coal-fired peakers. In the long term, carbon prices could be set high to make ESS more economical and encourage zero emission ESS deployment, along with potential ESS capacity price grants and ancillary service fees. Given this, electric peaking demand would largely prioritize ESS due to zero emissions. By 2030 and 2035, respectively, China has required cumulative ESS deployment to be 2.7TWh and 5TWh to meet electric peaking demand.

Our base case: >80% probability of materializing. Even without high carbon prices in China, LCOE of solar plus ESS with a >50% attach rate and >5 duration hours can reach cost parity with coal-fired peakers over the next decade. Sodium-ion batteries are already commercializing and will likely become a mainstream ESS technology in the next five years to further reduce costs significantly. ESS and thermal electric peakers will together meet peaking demand in future, we believe. We forecast 1.54TWh and 3.82TWh cumulative ESS deployment in China by 2030 and 2035, respectively.

Our bear case: Near 30% probability: Battery technology iteration stalls and ESS fails to reach cost parity with coal-fired plants, LCOE of solar & ESS integrated projects can only support a 30% attach rate and 3 duration hours at most. In this case, cumulative ESS deployment in China could reach 0.8TWh and 1.5TWh in 2030 and 2035, respectively.

Exhibit 61: Bull/base/bear cases for cumulative ESS deployment in China by 2035



Source: MIIT, e = Morgan Stanley Research estimates

Exhibit 62: Base case: annual incremental deployment forecast

Source: MIIT, e = Morgan Stanley Research estimates

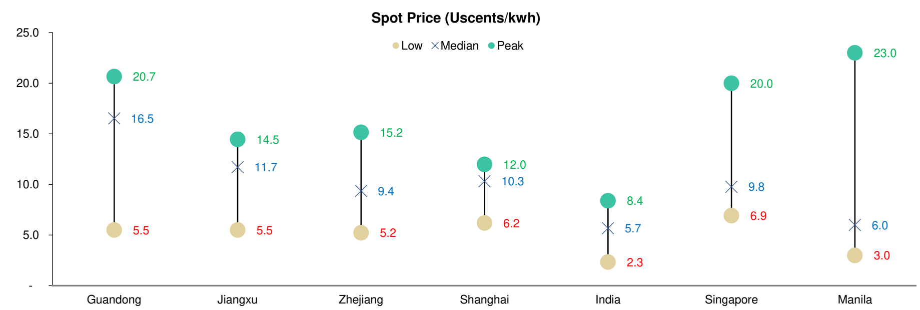
Surprise #2: The Changing Face of Power Markets

More liberalized power markets with rising tightness in supply

With tight power markets and higher intermittent renewable generation causing curtailments, regulators in in Asia are gradually turning to market-based mechanisms to balance power systems and costs. Power price differentials between peak and median have risen significantly around the world, with 10-30% higher peak prices and 10-20% deeper trough prices with negative power price occurrences also increasing 5-15%.

In China, renewable curtailments peaked at ~9% in 2024 and were ~6.6% for solar power in 2025. Regulators have introduced a policy that requires renewable projects commissioned after June 2025 to have market-linked pricing eventually. At end-2024, 55% of China's total wind and solar power volume participated in market trading and, as this set to rise to 100% in 2025, it is likely the market tariff decline trend will accelerate. In China, wind/solar utilization hours, which reflect actual power generation volume based on operational installed capacity, were in the range of six hours for wind and four hours for solar on average in 2024 for the top 10 operators, so we think gas can play a major role (along with batteries) to provide grid stability and also fulfill the need for mid to peak power requirements. India, which already has a liberalised power market, has required incremental renewable projects to be round-the-clock since 2024.

Exhibit 63: Spot power peak-trough spreads are significantly wider across Asia, making natural gas viable



Source: Company data, Morgan Stanley Research

Not All Kilowatts Are Equal: The Rise of Tiered Power Prices

Across major power markets, utilities and regulators are carving out distinct rate classes and bespoke tariffs for very large, price-agnostic or high-reliability loads (notably data centers) - separate from residential, small C&I, and even traditional large industrial users. Since ~2023, we've seen new “mega-load” riders, separate data-center classes, extra-high-load-factor tariffs, and customer-specific clean-supply tariffs, alongside deeper voltage/time-band granularity in network charges. The rise of round-the-clock data center power demand and higher bilateral corporate PPAs has also reduced available generation capacity for the rest of the market, driving up capacity payments from US$29/MW-day to between US$270/MW-day to US$329/MW-day in the tight PJM market. These changes aim to protect households and small businesses from grid upgrade costs while making heavy users pay cost-reflective rates (and, in some cases, fund clean, firm supply). By contrast, in 2010-15 most differentiation stopped at sector (residential/commercial/industrial), demand charges, and voltage discounts; bespoke classes for hyperscale loads were rare and residential dynamic pricing was nascent. More differentiated pricing allows regulators and power utilities to invest more while balancing the affordability of power prices.

Globally we are seeing the creation of separate price classes for "mega-loads"

- **US**: Across many utilities and states, large load tariffs are being designed and approved by utility commissions to protect existing ratepayers and reduce stranded asset risk. While each tariff is unique, similar key provisions across the country include minium charges, ramp schedules, exit fees, minimum demand thresholds, and credit and collateral requirements.
- **Ireland** – The Commission for Regulation of Utilities (CRU) "Large Energy Users" policy refresh (2024): CRU notes data centers rose from 5% (2015) to 21% (2023) of national electricity use and 85% of demand growth, proposing tighter connection policy and expectations around demand-side response, curtailment tolerance, and cost-reflective terms for LEUs - a de-facto differentiation vs. small users.
- **Spain** (2021 reform): New access tariffs (e.g., 2.0TD/3.0TD/6.1TD) split charges into energy vs. T&D components, added six time-of-day bands, and differentiates by contracted capacity and voltage - materially sharper signals for high-voltage/industrial vs. low-voltage users.
- **Japan** (TEPCO, 2024/2025): Revised extra-high/high-voltage rate options and retiring older options by Mar-2026, with explicit adjustments that better track procurement conditions - codifying different treatment for large, HV/EHV users.
- **Malaysia:** The introduction of new time (peak vs. off-peak) and voltage (low, medium, high, ultra high) based pricing structures rewards efficient use of consumption. Ultra-high-voltage grid users, like data centers, could see a ~14% increase in power bills, effectively paying ~US$140/MWh, in line with global benchmarks.

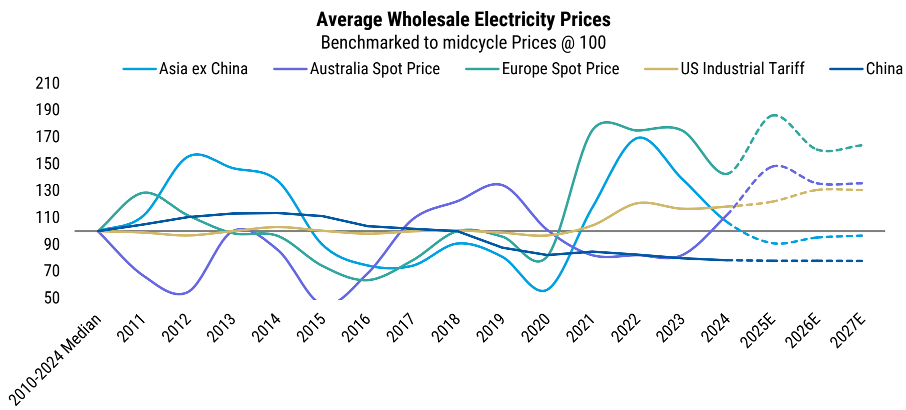
Regulators are focused on protecting marginal consumers while supporting grid investments

Globally, regulators have explicitly cited protecting other customers as the rationale for new data-center classes (e.g., Ireland CRU for LEUs). Differentiated pricing structures reward efficient use of consumption and ensures each customer category contributes its share of grid usage, enabling better cost recovery and providing certainty for grid expansion investments. In Malaysia, regulators are also using tiered pricing to support critical industries and drive industrial growth. High-efficiency medium-voltage users in Malaysia could see 5-13% lower bills, e.g. for high load factor industrial manufacturers such as electronics, autos, gloves and plastics, supporting industrial power demand which has remained weak post-Covid. By contrast, an ultra-high-voltage grid user, like a datacenter, could see a ~14% increase in its power bill. This differentiation aims to protect retail customers from bearing the full infrastructure costs of data center expansion.

Power Prices: Higher for a Lot Longer

Despite recent declines in coal and natural gas prices, we expect global power prices to remain structurally high. The traditional link between fuel costs and electricity prices is breaking down as decarbonization, grid constraints, and policy interventions reshape the sector. Another interesting area is the marginal cost of power production is rising with gas turbine prices doubling in the past three years and also solar panel and wind turbine cost increases have led to a 15-20% rise in marginal cash costs for new power generation, in our view.

Exhibit 64: We expect global power prices to remain high despite near-term weakness on lower coal and gas prices

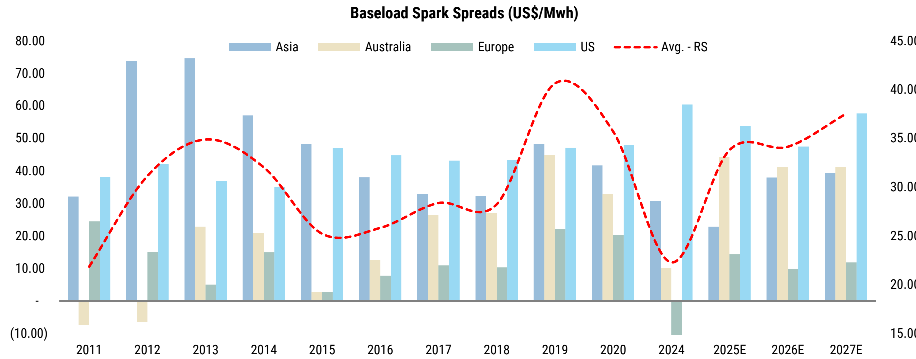


Source: Company Data, Bloomberg, IEX, EMA Singapore, EPPO Thailand, e = Morgan Stanley Research Estimates

Moreover, infrastructure upgrades, grid congestion, higher renewable intermittency and higher financing costs are being passed through to consumers, keeping system costs elevated. The IEA says global transmission investment rose ~10% in 2023 to US $140bn and must lift to US$200-300bn/year by the mid-2030s to meet policy and demand. Transformer and cable lead times have nearly doubled since 2021 (2-3 yrs for cables; up to 4 yrs for large transformers), with cable prices ~2× and transformers ~+75% vs 2019, according to the IEA. Even as input costs fall, wholesale and retail prices increasingly reflect the full cost of maintaining reliability including backup capacity, storage, and grid balancing, while underinvestment in baseload generation tightens reliability margins. Rising carbon costs and capacity payments further embed structural price pressures.

Power demand inflection is also driving additional baseload investments in new coal, gas and nuclear power plants. Across all regions, higher equipment costs, financing rates, and carbon policy risk mean new thermal projects now require structurally higher power prices or explicit capacity payments to clear investment hurdles. Examples such as PJM's record US$329/MW-day capacity auction in the US, Japan's ¥11,000/kW-year clearing price, and Germany's planned 10GW gas capacity tenders illustrate how governments and markets are embedding reliability premiums into price formation. In short, even with cheaper fuels, the cost of ensuring reliability amid the energy transition is locking in a higher global power-price floor. Power markets, particularly in Europe and parts of Asia, will likely see sustained price volatility and elevated average prices, underscoring the resilience of structural inflation in energy systems.

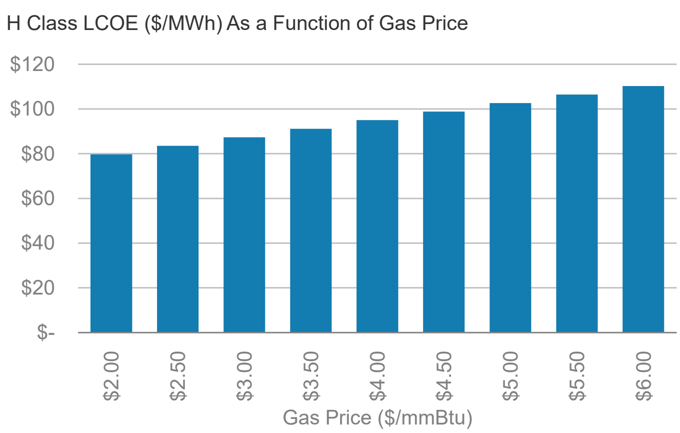
Exhibit 65: We expect baseload spreads to remain above mid-cycle given tight power markets



Source: Company data, Bloomberg, IEX, EMA Singapore, EPPO Thailand, e = Morgan Stanley Research estimates

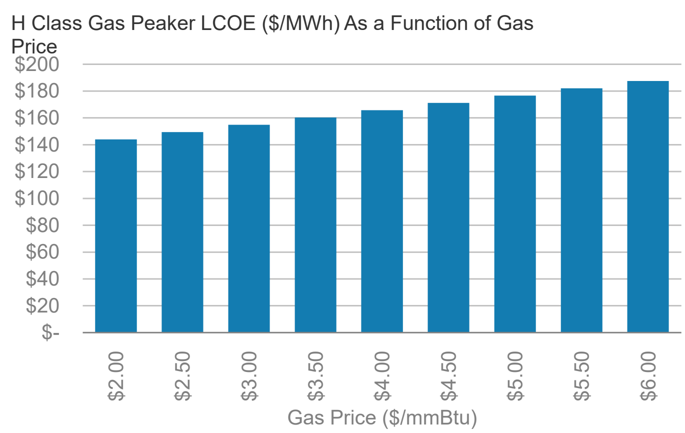
New power plants need higher prices (or explicit support) to clear hurdle rates and prevent stranded assets

Exhibit 66: Breakeven cost of electricity of a new H Class Gas turbine @ 12% Equity Return



Source: Morgan Stanley Research estimates

Exhibit 67: Breakeven cost of electricity of a new H Frame Gas Peaker @ 12% Equity Return



Source: Morgan Stanley Research estimates

Capacity prices now carry a larger share of the revenue stack in US, Japan and Europe.

- **PJM** 2026/27 capacity auction hit the cap: US$329.17/MW-day across the RTO. That equals ~US$120,147/MW-yr (≈US$120/kW-yr) and PJM indicated the price would have been ~US$388.57/MW-day absent the cap - i.e., even higher required revenues. This is consistent with Net CONE-based caps for new gas entry.
- **UK:** £60/kW-yr from the T-4 (2028/29). At ~US$1.25/£, that's ~US$75/kW-yr in capacity revenue before any energy margin.
- **Japan:** FY2028 auction average ¥11,134/kW-yr (≈US$74/kW-yr at ¥150/$), with Tokyo/Tohoku ¥14,812/kW-yr (≈ US$99/kW-yr), explicitly lifting fixed-cost recovery for gas and other dispatchables.

Fixed costs & WACC have risen; new-build gas requires strong energy + capacity revenues.

- LCOE for new CCGT (US) is now ~US$48-107/MWh (Lazard 2025), up versus earlier years; turbine supply bottlenecks and higher financing costs are key drivers.
- CONE / Net CONE studies for PJM (Brattle/S&L) show the system's capacity price caps and curves are anchored to the cost of new gas entry, signaling the level of (non-energy) revenue a new plant requires are rising.
- EIA AEO2025 explicitly adds +300 bps to cost of capital for new NGCC (policy/ CO_2 risk), raising required returns and, therefore, the price/revenue needed to finance new units.

Coal & Gas new-builds require explicit long-term tariffs/PPAs to avoid stranded assets

Long-term fixed PPAs across the asset life would de-risk cash flows for lenders to sponsor the multi-billion dollar capex required. Lenders, regulators and asset owners are in alignment to avoid stranded assets - much like what has happened over the previous decade when power demand was benign. For example, India is pairing the new state PPAs with coal linkages (SHAKTI) to ensure project bankability. ~14.5GW of PPAs have been signed under this arrangement with tariffs ranging from ~Rs5.5-6.2/unit. We believe these new PPAs will not only de-risk the developers from the issues of coal price variability and availability challenges but will also drive mid to high-teen IRRs

Surprise #3: Consumers Want to Produce Their Own Power

A growing set of power-intensive end users - especially data centers and heavy industry - are building or sourcing their own plants to get reliable power faster than today's interconnection queues allow, while regaining cost and operational control. In 2024-25, US data-center operators began deploying on-site gas turbines ("power foundries") on accelerated schedules, and in Texas some facilities are bypassing the grid entirely; in Germany, operators plan on-site gas because grid links can take 7-15 years; and in Ireland, proposed rules require on-site generation or storage to secure a grid connection. Industrial "captive" fleets are expanding too - Indonesia reached ~22.9GW of captive capacity in 2024 (≈81% coal). Most sites still keep a grid tie for backup and market access, but the center of gravity is shifting towards hybrid models (on-site + grid). The upside is speed-to-power and reliability; the trade-offs are capex, fuel and emissions, and added operating complexity - pressuring utilities, OEMs, and policymakers to rethink grid planning, connection policy, and carbon accounting. Beneficiaries include power equipment providers and grid operators, we do not see this as a threat to incumbent power generators as we expect power markets to remain tight.

Case Study: Indonesia operates 49.7GW of coal-fired power plants, 11.2GW of which are captive (off grid) coal power. Captive coal has grown nearly fivefold, from 2.3GW in 2014 to 11.2GW in 2023. Indonesia's 2021-24 boom in metal smelter projects illustrates how load growth from smelters creates bankable coal baseload power demand in underdeveloped areas with low grid access. Smelter projects require a significant amount of power to operate, and project owners have developed adjacent captive coal-fired power plants that are typically behind-the-fence with industry-linked offtake, shielding plants from spot volatility and anchoring finance despite global coal headwinds. 2024 alone saw additions of ~1.9GW, the majority of which were captive.

Who's adding captive power?

- **US:** Data centers are adding on-site gas to secure multi-year, high-availability power as demand from AI surges. GE Vernova disclosed "power foundry" projects using 7HA gas turbines to supply co-located US data centers on an accelerated timeline (first units by end-2027).
- **Germany:** Operators plan on-site gas plants because grid connections can take 7-15 years; e.g., CyrusOne Frankfurt will add a ~61MW gas plant (from 2029) to supplement its grid link.
- **Ireland:** Regulator proposals require new data-center connections to include on-site generation or storage to "match" load; policy reflects severe Dublin-area grid constraints (rule trajectory since 2021, proposals updated Feb 2025).
- **Industrial "captive power" (EMs):** Indonesia's captive fleet reached ~22.9GW in 2024 (≈81% coal-fired) as nickel/metal smelters built behind-the-fence plants; captive coal additions outpaced grid-tied builds in 2023-24.

- **India:** Energy producers in India have planned 30GW of power generation capacity to power refineries, petrochemicals, new data centers and also power new investments. Overall captive power lowers cost of power for these corporates by about half.

Advantages of operating captive power systems

- **Speed-to-power** vs. multi-year interconnection delays (Germany: 7-15 years typical range cited).
- **Reliability/availability tailored** to 24/7 loads (data centers), with black-start and ride-through features; vendors (e.g., Wärtsilä) market engine plants for primary data-center power.
- **Cost/control of energy stack** (hedging against volatile nodal prices; choice of fuel/logistics). Evidence of DCs installing gas turbines specifically for dedicated supply.

Disadvantages of operating captive power systems:

- **Capex/WACC & fuel logistics** borne by the user; permitting and local air rules add risk.
- **Carbon profile** (gas/coal) complicates net-zero claims; may need offsets/PPAs separately.
- **Operational complexity** vs. outsourcing power needs to utilities/IPP.
- **Possible stranded assets** in the long run if the intended end user demand is canceled or cannot be redeveloped.

Grid connection remains sacrosanct

Even when adding on-site gas/CHP, large users typically retain grid ties for redundancy, portfolio renewables, and market access (imports during outages, exports during surplus). Germany's CyrusOne case explicitly supplements (not replaces) the grid. While in Ireland grid access is conditional on deploying on-site power or storage, creating hybrid "grid-plus-onsite" designs by default. In 2025, Constellation Energy said it is refocusing on grid-connected AI/data center power projects, moving away from fully off-grid schemes. The company remarked that on-grid sales are "increasingly attractive" and that some prior off-grid/co-located proposals faced regulatory scrutiny and reliability/cost externality concerns. Developers still prize grid interconnection for load balancing, energy arbitrage, and stability.

Datacenters as a grid balancing tool?

- **Demand response / load shedding / shifting**: Data centers can momentarily shed or throttle non-critical compute loads during high system stress, contributing to peak relief or system stability. For instance, in the US, Google has agreed to curb power use at its AI data centers during grid stress in programs with Indiana Michigan Power and the Tennessee Power Authority.
- **Frequency regulation / ancillary services**: Because data centers have fast electronic switching, they can provide fast frequency response (FFR), adjusting load up or down in response to frequency deviations. Grid-interactive UPS systems

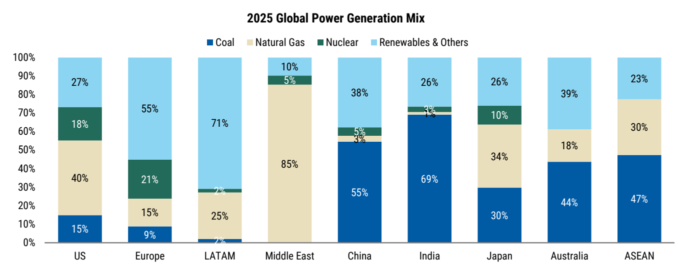
and storage can help. Simulation studies show that with proper control, data centers can bid into regulation markets and deliver up/down adjustments.

- **Flexible scheduling / job shifting**: Workloads (e.g. batch AI training) can be scheduled in times of high renewable generation, or shifted geographically across data centers to align with lower grid stress. This is a form of computational load flexibility.
- **Grid-interactive UPS / battery / hybrid systems**: Many modern data centers include Uninterruptible Power Supply (UPS) and battery systems. If these are made "grid-interactive," the data center can use stored energy to reduce draw (or even inject) temporarily as part of grid services.

Surprise #4: More Fossil Fuel-Based Generation

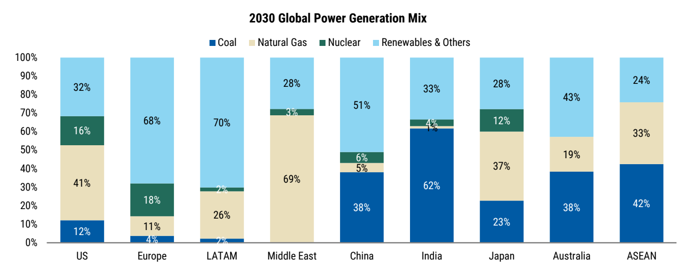
We forecast global power demand to grow by ~6,000TWh in 2025-30 but estimate generation from renewables (incl. hydro) will only provide half of this demand, leaving a lot to be produced using fossil or nuclear fuel. We see natural gas power generation meeting a fifth of this growth through 2030 while stabilising the grid, especially with net ~230GW of global coal-based generation capacity shutdown by 2030 (Exhibit 69). Higher renewable curtailment risks, especially given years of underinvestment in grids, will keep natural gas and renewables working together for most of this decade, we believe. In the US, we estimate 15-20GW of gas based power generation supporting datacenter demand, in Asia we estimate 15-17GW of gas-based power generation and in Europe 7+GW of new gas-based power generation by 2030. In Australia, there is optionality to raise gas-based generation as coal plants retire and so is the case in Japan, where we see challenges for the country to reach its renewable target leading to higher gas-based power generation.

Exhibit 68: We see the global fuel mix, which is largely coal dependent in 2025, changing ...



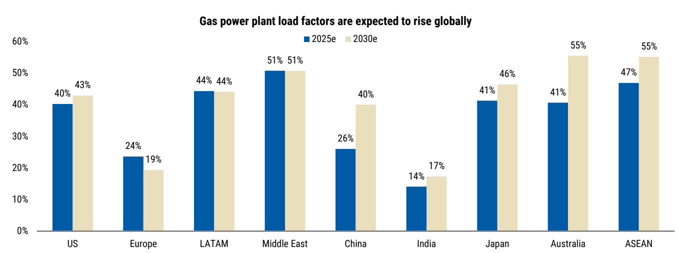
Source: Company data, Statistical Review of World Energy, Morgan Stanley Research estimates

Exhibit 69: ...We think the global fuel mix by 2030 features more gas and renewables across regions



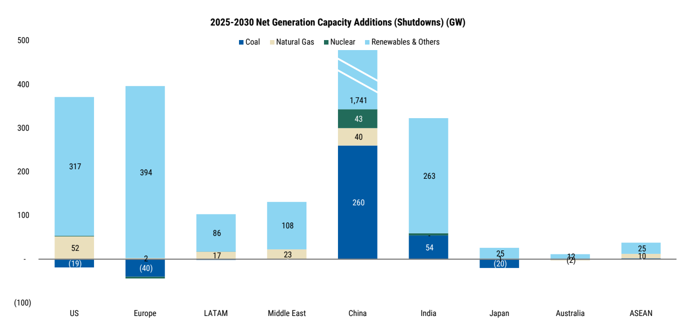
Source: Morgan Stanley Research estimates

Exhibit 70: Gas power plant utilisations are expected to rise, despite significant capacity increases



Source: Company data, Statistical Review of World Energy, Morgan Stanley Research estimates

Exhibit 71: Renewables and gas generation assets are being added globally while we see more shutdowns of coal assets outside of China

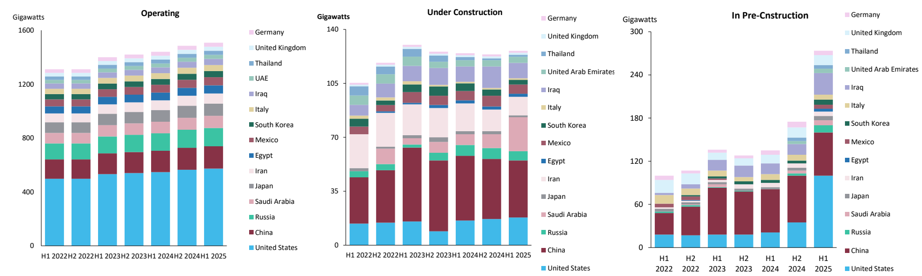


Source: Morgan Stanley Research estimates

Demand is driving new fossil baseload builds to support renewables

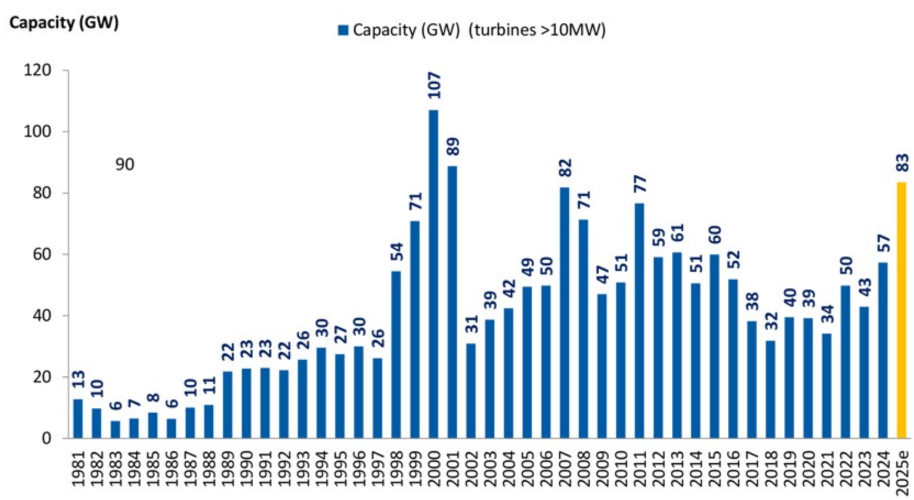
Investor debate over the reliability of renewables as base load and the readiness of the grid has been picking up traction over the past year, as renewables reach ~30-40% of power generation in Europe (Exhibit 68), curtailments rise for renewables in China, and new investments in gas-based and nuclear restarts/small reactor power plants show up in countries like US, India, Malaysia, and the Philippines. Gas power plants are quicker to construct in most parts of the world (vs other conventional and nuclear power plants) and turbines coming to the end of their asset life can also be retrofitted with new turbines at minimal incremental capex to accept 25% green hydrogen to lower emissions.

Exhibit 72: Global natural gas power plant capacity in top 15 gas power producing countries; The USA has around 25% of global gas power capacity in operation and in pre-construction



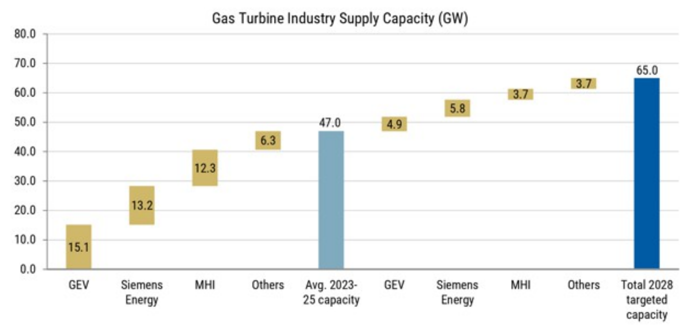
Source: Global Energy Monitor, Morgan Stanley Research

Exhibit 73: Global Gas Turbine Orders: 2025e is annualising at ~83GW, tracking to be the best year since 2007 (82GW), and also 57% higher than the 20-year average of 52GW



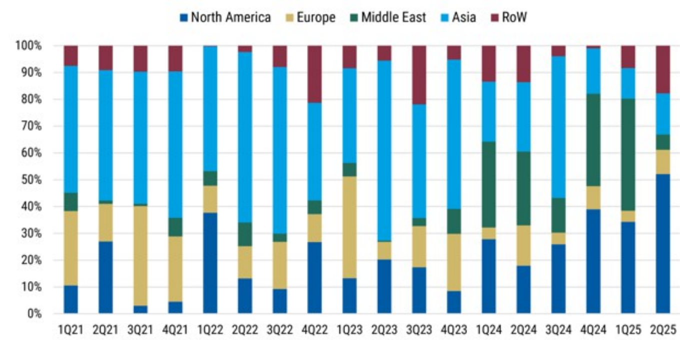
Source: McCoy data, e = Morgan Stanley Research estimates

Exhibit 74: Gas turbine supply remains tight with ~65GW of supply by 2028e compared to orders of >80GW in 2025



Source: McCoy, e = Morgan Stanley Research estimates

Exhibit 75: US has formed a larger portion of new turbine orders in recent quarters.



Source: McCoy, Morgan Stanley Research

United States (Data center drives new gas plants)

- **Pennsylvania:** Redevelopment of Homer City coal power plant to a 4.5GW natural gas power plant powered by seven GE Vernova turbines should begin operations in 2026, according to GE Vernova.
- **Louisiana:** Regulators approved three new CCGT plants plus 1.5GW solar and new transmission to serve Meta's US$10bn AI data-center campus (Richland Parish). Two CCGTs targeted for late-2028, the third by end-2029, according to Power Engineering.
- **ERCOT & PJM:** NRG Energy, GE Vernova and Kiewit Corp consortium building four new power plants totalling 5GW serving the ERCOT and PJM market, according to POWER Magazine.

Japan (data center and semiconductor manufacturing drives new gas plants)

- LNG-fired capacity projected to rise to ~86GW by 2034, from ~80GW (2024); auctions in the past two years awarded ~7GW of gas-fired capacity, according to Gas Processing News.

Europe (reliability amid coal plant closures drives new gas plants):

- **Germany** plans tenders for ~10GW "hydrogen-ready" gas and a capacity mechanism by 2028 to guarantee a business case as renewables rise and coal retires, according to Clean Energy Wire.

India (surging baseload demand drives new coal plants)

- The government has formally proposed at least 80GW of new coal over F23-32, citing reliability and demand growth;
- The allowable capex in recent bids has increased to as high as ~Rs130mn/MW.
- Recent state bids announced have coal linkages under SHAKTI policy which helps de-risk the developer from coal price variability and availability risk.
- At the same time, tariffs have risen to ~Rs5.5-6.2/unit which should enable developers to make mid to high teen IRRs.

Indonesia (industrial "captive" load drives new coal plants)

- 2024 added ~1.9GW of coal, ~80% captive for metal smelters; between Jul-2023 and Jul-2024, captive coal capacity rose 4.5GW (vs 2.6GW grid-tied), driven by industrial demand shields from grid volatility.

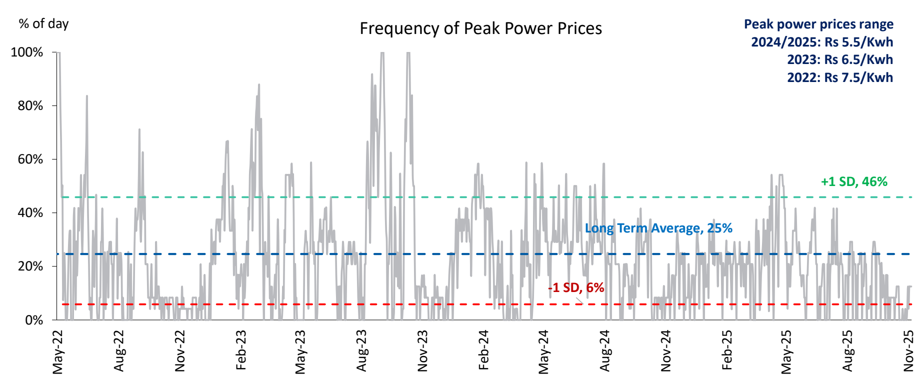
China (reliability & regional demand drives more coal plants):

- Construction started on ~94.5GW new coal in 2024, a 10-year high, reflecting reliability and peak-demand concerns (even as 2024-25 permitting slows).

More liberalized power market drives unit economics for gas-powered electrons

Asia power markets are moving towards market-based trading mechanisms over a fixed-priced PPA regime at a time when power markets are tight, renewable penetration is increasing and power demand enters a new growth phase. We expect more volatility in power prices, and greater intra day peak-to-trough spreads in power prices. This increases unit economics for stable gas-based power generation. The predominant provider of balancing services, owners of dispatchable power (peaker plants, OCGT, energy storage) should be the key beneficiaries of higher balancing costs and should underpin higher-for-longer free cash flow for these operators, especially in regions where grid investments have not been sufficient. Operators such as Sembcorp Industries in Singapore should benefit. PetroChina has abundant gas resources with competitive cost, even compared with coal. Its all-in cost at well head reached Rmb0.8-0.9/cm in 2024, which allows gas power cost at Rmb0.2-0.23/kWh, vs. Rmb0.36/kWh average on-grid benchmark tariff in China.

Exhibit 76: Around 25% of the time, daily power prices hit peak levels – highlighting the role of gas-based power in stabilizing the grid



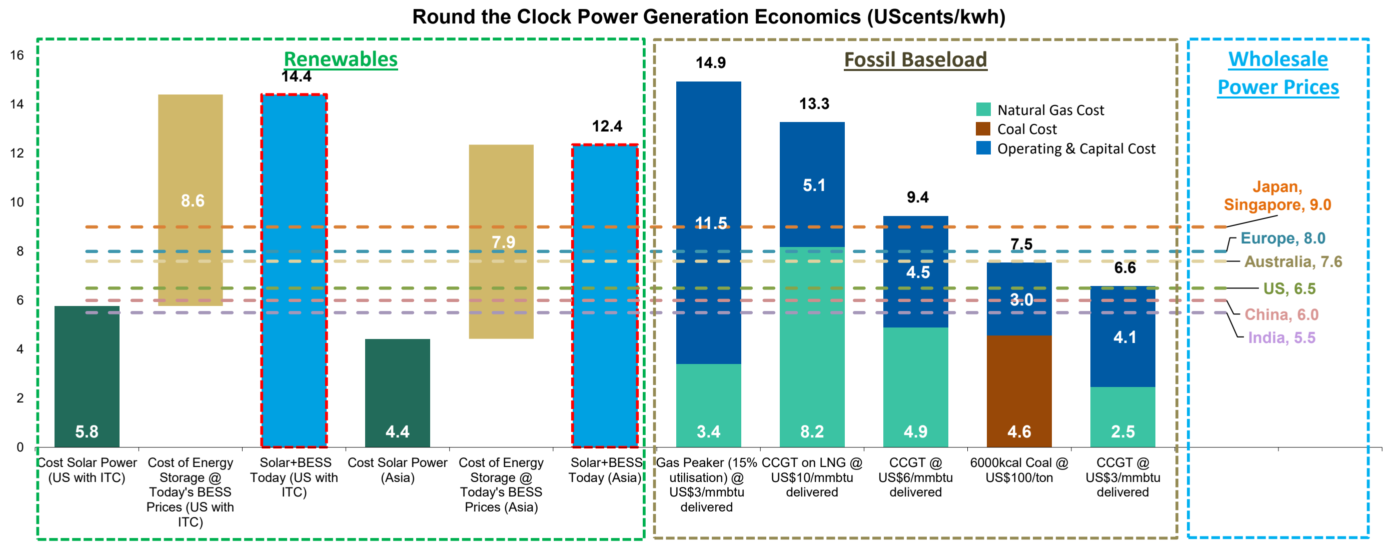
Source: IEX, Morgan Stanley Research

Can natural gas compete with coal and renewables?

Rising inelasticities in natural gas demand: Natural gas has found faster adoption as a transport fuel but has struggled to compete with cheaper coal in Asia for the past decade. This is changing for a few reasons: 1) Rising domestic supply in China and India makes natural gas more competitive. 2) Higher base load demand in Malaysia/Philippines/ Singapore from data centers and new generation manufacturing, leads to higher needs for peak load gas-based generation. 3) Renewables + cheaper LNG imports + higher mix of contracted LNG (less so spot) also can compete with coal, as power trading rises in Asia. 4) Carbon targets drive faster coal-to-gas switching, especially in China where we see mandatory industrial boilers burning gas and a coal-to-gas switch in rural areas. Over the past two years when global and domestic gas prices have risen, we have seen demand in key Asian markets be sustained at higher growth levels – a contrast to pre-Covid when demand elasticity to price was higher.

Gas is also more competitive for renewables+energy storage systems when taking into account round-the-clock power requirements, which regulators are more focused on today given grid constraints and rising datacenter power demand.

Exhibit 77: Round-the-clock cost of gas-based electricity generation is more competitive than renewables with batteries and almost near coal parity, while imported LNG-based electricity can be used for peak loads.



Source: Company data, Morgan Stanley Research estimates

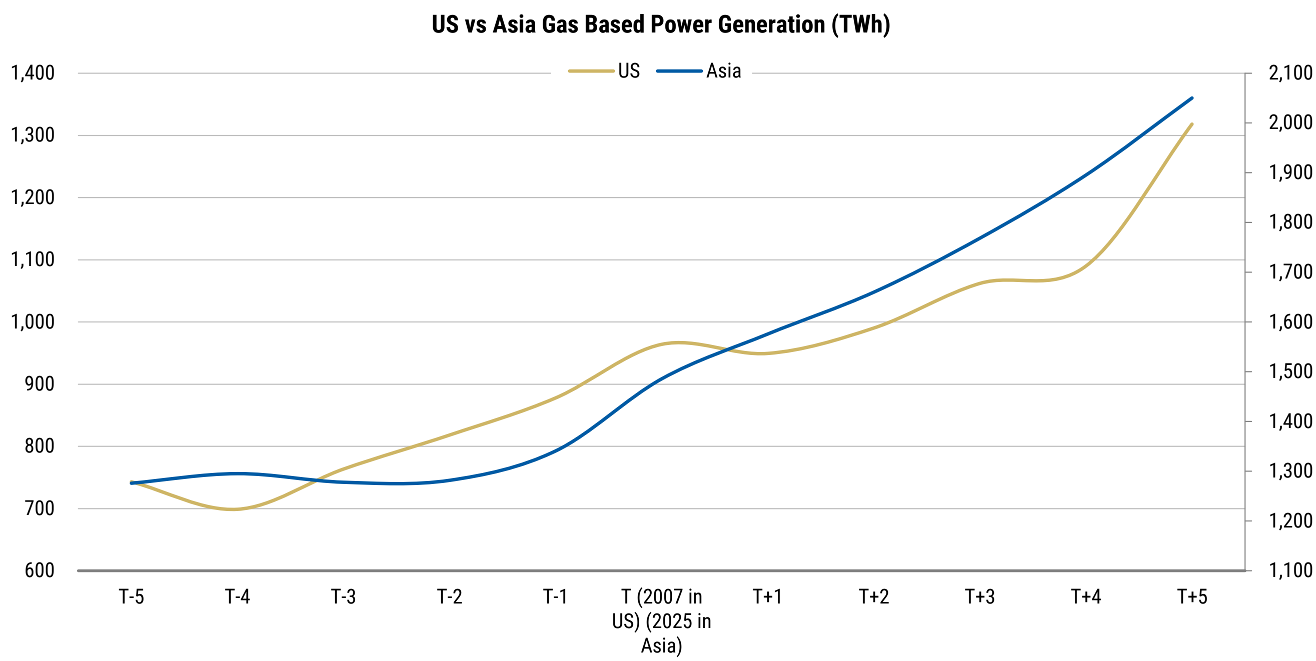
Gas: More flexible vs coal; key in the age of renewables: Coal-fired power plants generally face limitations in technical flexibility because of their relatively high minimum load requirements - around 25-40% for hard coal units and 50-60% for lignite plants - and their comparatively slower ramping capabilities. Like many other generation technologies, their operation is influenced by minimum generation thresholds, efficiency losses at partial load, and the costs associated with shutdowns and restarts, which all play a role in dispatch decisions. Even when coal plants aim to reduce output during periods of negative electricity prices, their response can be too slow, meaning they continue to generate power while ramping down. While such issues can arise with gas-fired units, these typically benefit from higher ramping speeds, which could be under an hour for a hot start, while coal plants could require 6-24 hours to ramp up.

New Natural Gas Supply creates demand in the new world order

"*Demand for LNG is expected to increase by roughly 60% by 2040. This is mainly driven by economic growth in Asia, electricity demand from artificial intelligence and emissions reduction plans driving gas demand within heavy industry and transport*", Shell Investor Day, 25 March, 2025

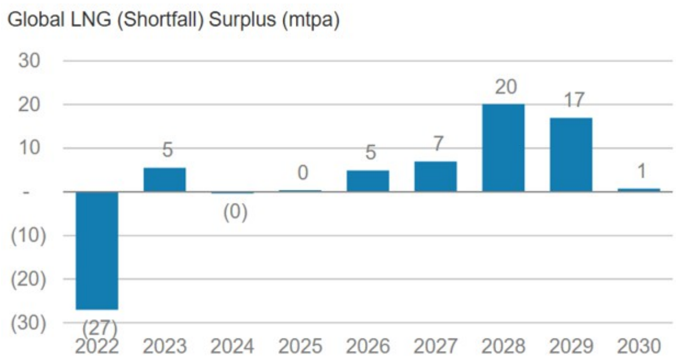
The impact of upcoming global and local natural gas supply on demand could surprise as new avenues in power, LNG trucking, CNG vehicles and the hard-to-decarbonise industrial sector grow Asia's gas and LNG consumption by ~120mntpa, seeing the region at the forefront of this new normal in gas consumption with imports from the US. We estimate Asia's (ex-China) dependence on US natural gas will more than double this decade and re-wire supply chains for energy consumption across sectors – technology, new energy and transportation. LNG helps create a lower trade surplus with the US for key countries, like India, Indonesia and Japan, by up to 20%. Being a price-sensitive market, we believe LNG-delivered pricing of US$10/mmbtu is a sweet spot for Asia. Meanwhile, Asia will see an increasing trend of oil – or Henry Hub-linked contracts – implying 8-9/mmbtu for contracted LNG, i.e slightly lower than the US$10/mmbtu long-term LNG price in our estimates.

Exhibit 78: We see Asia gas-based power generation inflecting ahead, similar to the US when cheap Shale Gas drove the adoption of natural gas in power generation



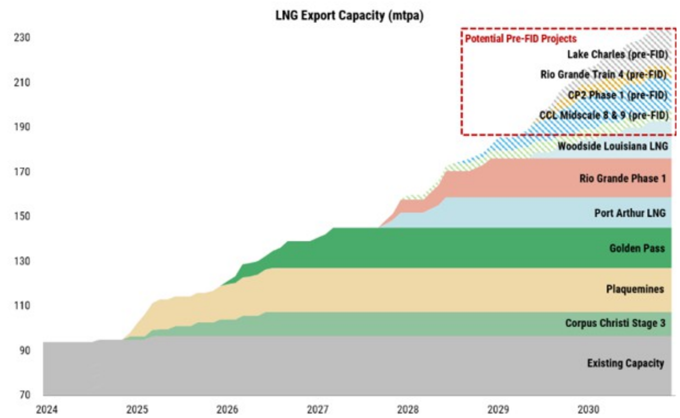
Source: Statistical Review of World Energy, Morgan Stanley Research estimates

Exhibit 79: After a balanced 2025 due to low EU inventories, we see the market swinging to a surplus next year with peak oversupply later this decade. Higher Asia demand helps absorb this surplus by 2030.



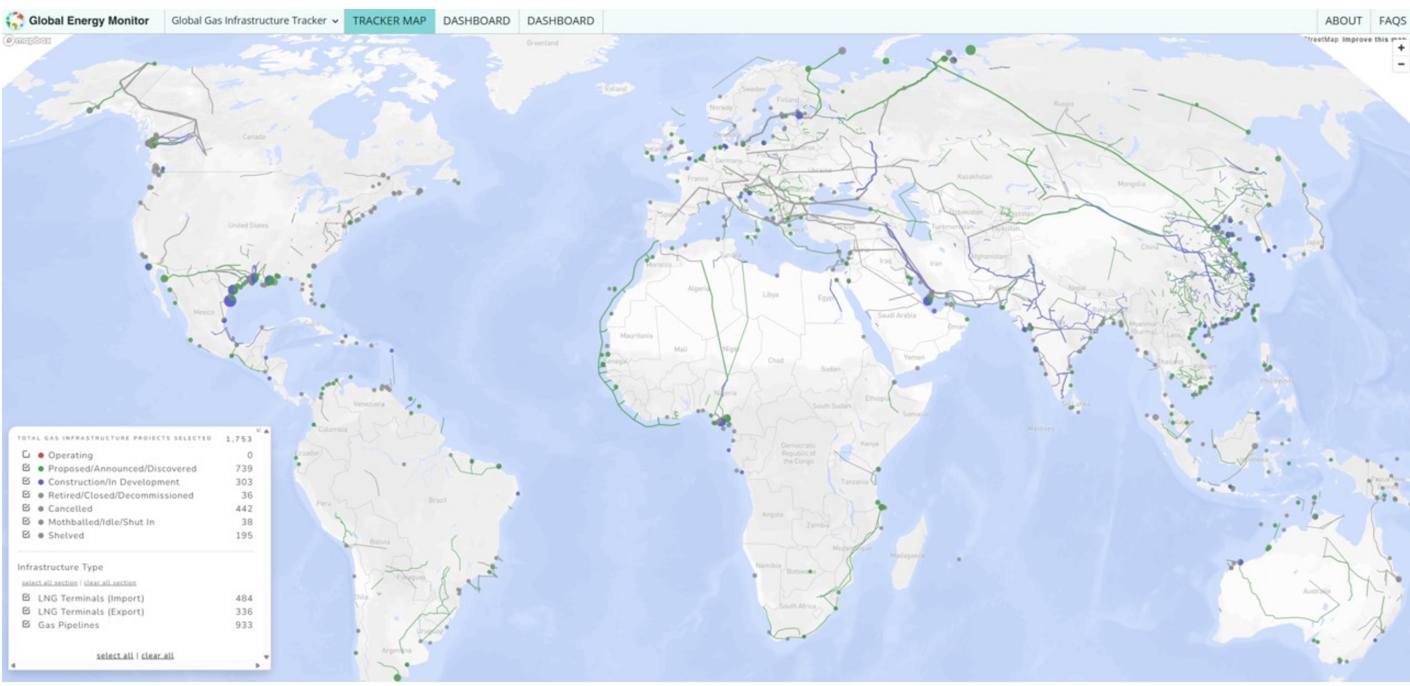
Source: Wood Mackenzie, Morgan Stanley Research estimates

Exhibit 80: The US is a key driver of this growth, adding ~95 mtpa of global supply over the next 5 years. Additional FIDs would push this figure higher



Source: Wood Mackenzie, Morgan Stanley Research

Exhibit 81:
Significant gas infrastructure under construction and announced in US and Asia will drive incremental LNG flows and drive gas demand in Asia



Source: Global Energy Monitor Website

Renewables: Will Returns Return?

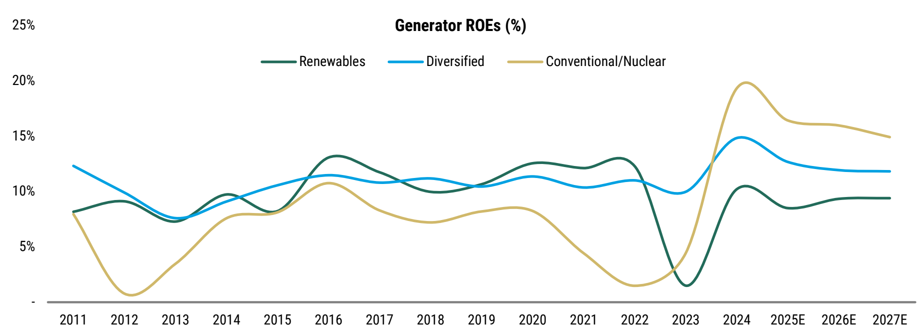
Renewables are seeing different headwinds and tailwinds in each region. While new renewable generation remains strong, we are seeing the market structure and pricing change in most areas with improving quality of returns and pricing structure for solar and increasingly wind. However, rising equipment costs, higher curtailments and limited selling price increments are challenging the outlook for renewable operators, especially in Asia, offsetting the potential impact of lower power rates.

In the US, we are bullish on renewables demand given the acceleration of load (~2.6% CAGR through 2035) and supply chain difficulties on the gas side. Renewables are generally faster to get online, and we would consider the One Big Beautiful Bill (OBBBA) legislation to be better than expected. On economics, in all instances and even in the absence of renewables tax credits, wind and solar are at least on par with new gas generation, if not better.

In Europe, we believe that value creation levels have stabilised at comfortable levels for renewable projects. About 18% of sector EBITDA from renewables is mostly secured offtake. We see ROEs stabilizing in Europe with potential upside from higher pricing power from hyperscaler offtake.

In Asia, most countries have seen rising curtailments, increased consolidation and also more market-driven pricing for renewable power away from PPAs, which is leading to return challenges. Multiple high-load consumers are also producing their own power, while most data centers are served by grid power outside of China. However, China is seeing increased battery storage buildup to adapt to new power pricing reforms for renewables, which links it to merchant market pricing rather than PPA.

Exhibit 82: Street expects below mid-cycle ROEs for renewable players, while conventional energy and nuclear players see the largest ROE uplift



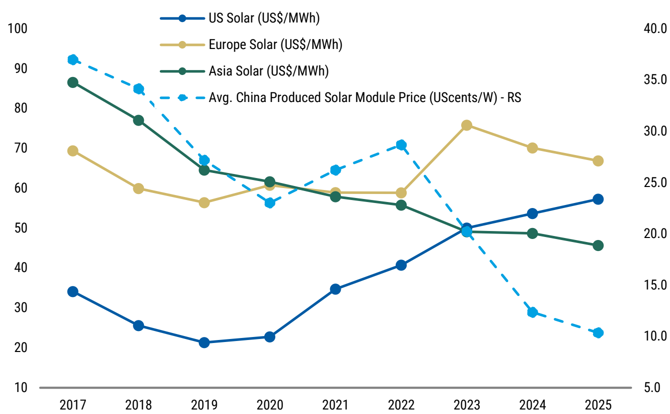
Source: Refinitiv, *Refinitiv Consensus estimates

PPA prices have risen in most regions, ex-Asia

In the US, average PPA prices for renewables vary between US$60-75/MWh, and have doubled in the past five years for solar and wind. In Europe, they average near US$70/MWh and have been flattish in past five years. However, in Asia, due to weaker local currencies vs USD, PPA prices have declined 15% for solar and wind since 2020 (Exhibit 83). As a result, we have seen a lot more consolidation as cost of capital has risen making scale an important factor to keep renewable returns above the cost of capital in India and

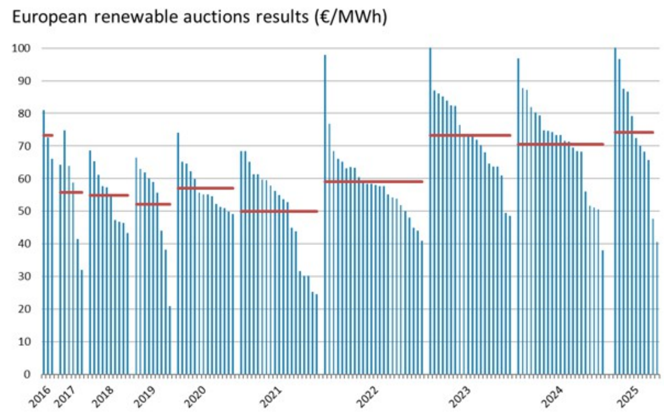
Southeast Asia. In China, however, a large part of the PPA price decline has been absorbed by solar equipment manufacturers as they have lowered prices for panels and wind turbines by an average 20-30% in the past five years.

Exhibit 83: Solar PPAs auctions prices have not had the same pace of decline as equipment cost



Source: PVinfo, Morgan Stanley Research

Exhibit 84: Wind & solar government auction prices in Europe remain significantly higher than in 2021 despite a recent small decline



Source: Various sources, Morgan Stanley Research

The Story of Rising Curtailments for Renewables

Curtailment of renewable power is rising globally, especially in places where wind/solar growth has outpaced transmission, storage and flexible demand. Hotspots include Western China, California and the US Midwest, Europe, parts of Australia, northern Chile, Brazil's Northeast, and India's Rajasthan. Midday oversupply and grid congestion is largely the cause. Renewable returns are impacted as near-term policy responses are centered on accepting a "normal" level of curtailment as least-cost, which prevents renewable operators from dispatching power. (Exhibit 85) See our section Surprise #1: Grid Constraints: Everywhere, All at Once

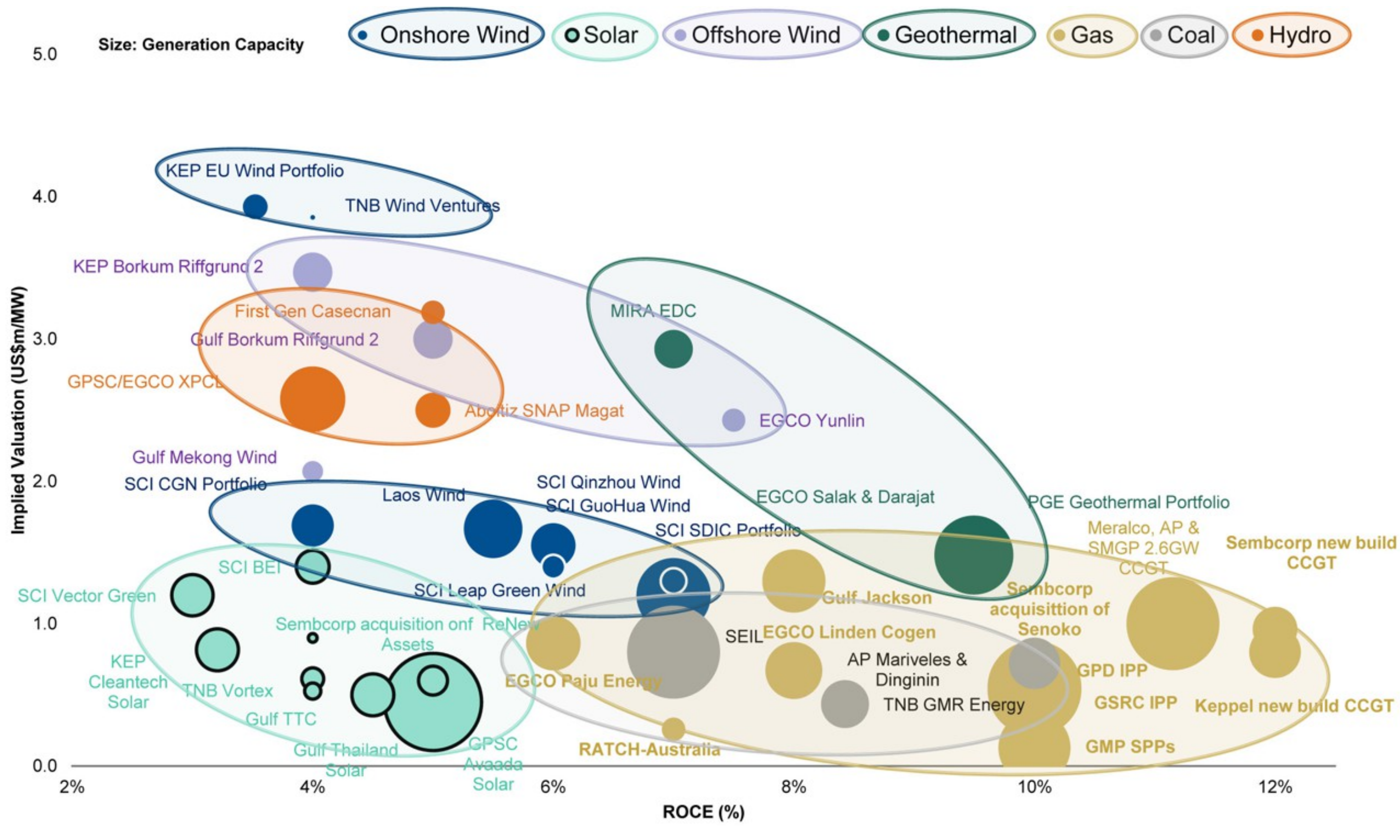
How does curtailment affect renewable operators' earnings: Curtailment hits earnings mainly by cutting the volume of power a renewable operator can sell to the market. The extent of the impact on earnings depends on the contract/market design and whether the operator is compensated for "constrained-off" energy. Most merchant/grid PPA contracts do not offer curtailment protection and while CfD contracts in Europe do offer compensation for negative prices, timing, settlement friction and volume risk does exist.

Exhibit 85: Earnings sensitivity for new solar projects

Solar Project Earnings Sensitivity		Curtailment					
		0%	2%	4%	6%	8%	10%
Module Price (US$/w)	0.14	4.8%	2.8%	0.8%	-1.3%	-3.5%	-5.8%
	0.15	3.2%	1.2%	-0.8%	-3.0%	-5.2%	-7.6%
	0.16	1.6%	-0.4%	-2.5%	-4.7%	-7.0%	-9.3%
	0.17	0.0%	-2.0%	-4.2%	-6.4%	-8.7%	-11.1%
	0.18	-1.6%	-3.7%	-5.8%	-8.1%	-10.4%	-12.9%
	0.19	-3.2%	-5.3%	-7.5%	-9.8%	-12.2%	-14.7%
	0.2	-4.8%	-6.9%	-9.1%	-11.5%	-13.9%	-16.4%
	0.21	-6.4%	-8.5%	-10.8%	-13.2%	-15.6%	-18.2%

Source: Morgan Stanley Research Estimates. *: Assumes increases in module costs is not passed through and assumes a fixed tariff Power Purchase Agreement

Exhibit86: Renewable projects earn a return below traditional projects



Source: Company data, Morgan Stanley Research

Clean Power Equipment: An End to the Deflation Era

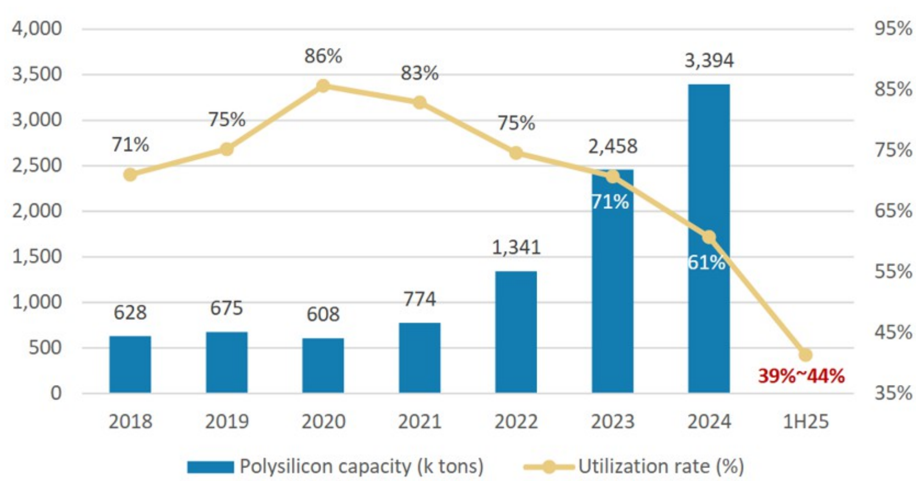
Clean power equipment has reversed its 2021-23 cost inflation and returned to pre-Covid trends driven by the reversal of material cost inflation, as supply chains improve and global clean power equipment capacity grows locally in multiple demand centers. While we expected this in 2023, as highlighted in the note Clean Power: Deflation Path Supercharges Adoption, the pace of decline has surprised us and the street, and we see equipment costs finding a floor driven largely by China's anti-involution policies (see China's Anti-Involution: Implications for the Global Solar Value Chain).

We think the full extent of oversupply has been realised for solar and wind value chains with module and battery cell prices below pre-Covid levels, and with producer ASPs in China below cash cost. Policy driven supply consolidation in China should see polysilicon and PV module price increases over the medium term, while the global wind turbine value chain is seeing more price rationalism. While we continue to see new supply chains forming globally on energy security concerns (see Supply Chain Diffusion is Accelerating), total capacity under construction remains significantly less than the supply chain curtailments from China. Moving forward, we think technological and manufacturing efficiency gains will be required to drive the next leg of deflation.

China manufacturers' utilization rates are critically low, driving consolidation

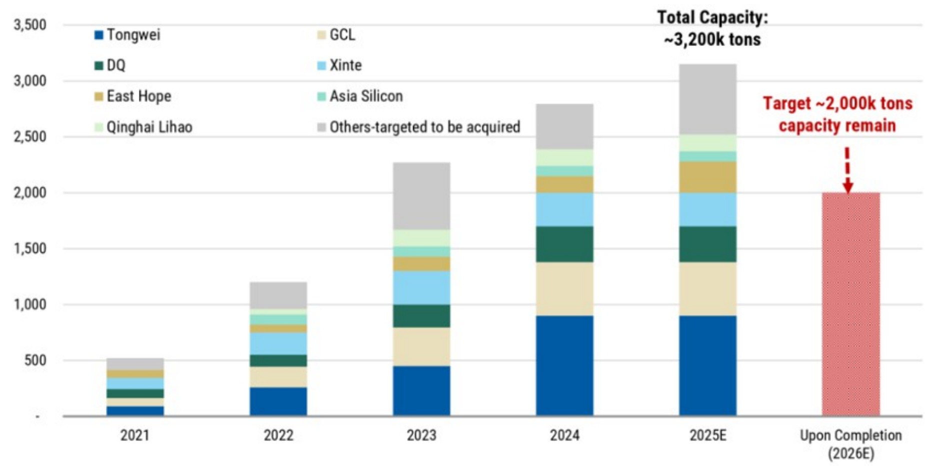
The polysilicon industry has reached a critical juncture where market consolidation has become more urgent to address severe overcapacity and persistent losses. In 1H25, the average polysilicon utilization rate fell to 39-44% from 61% in 2024.(Exhibit 87) Recognizing this, Tongwei led an industry-wide acquisition proposal for supply reform, with a yet to be determined number of polysilicon producers set to establish a joint industry acquisition fund (modeled in a similar way as OPEC) to acquire other small and mid-sized polysilicon players for industry consolidation as well as excess inventory. We expect the acquisition fund to phase out the existing capacity and acquire excessive inventory, and possess ~2,000k tons upon completion.

Exhibit 87: China's polysilicon utilization rate fell to 39-44% in 1H25



Source: CPIA, Morgan Stanley Research

Exhibit 88: China's polysilicon industry targeting to retain ~2,000k tons (equivalent to ~1,000GW) capacity while phasing out remaining operating capacity in the medium term



Source: Company data; Estimates based on company announcements and government press announcements.

Implications for China's Solar Value chain: Equipment cost inflation

Polysilicon has led the ASP rebound YTD, underpinned by the NDRC's price-floor policy framework introduced in July 2025, up 33% YTD as of November 5th. This has passed through to the supply chain for wafers and cells, with 20-45% price rebounds vs. early July. In contrast, modules have been slow to reprice, recovering only 0-3% in the same period, as power plants have been reluctant to accept cost increases given IRR concerns, amid uncertain power tariffs after the policy nodes of market tariff reforms introduced in May, and rising curtailment in certain regions of China, while module producers' bargaining power also remains weak amid oversupply and a fragmented market.

Our China solar analyst, Eva Hou, expects most module producers to achieve gross profit breakeven by 2H26 in our base case (Exhibit 67). Following our assumption of a wide ASP recovery across the solar value chain, we expect most integrated module producers to begin to achieve gross profit breakeven from 2H26 and become meaningfully profitable by FY27, with a 9% GP margin on average. We assume a faster margin uptick in 1H26 under our bull case, and a delay until 1H27 under the bear scenario given different paces of polysilicon ASP recovery.

Exhibit 89: ASP forecast across the supply chain - scenario analysis

ASP (incl. VAT)	2022	2023	2024	2025e	Base case		Bull case		Bear case	
					2026e	2027e	2026e	2027e	2026e	2027e
Polysilicon (Rmb/kg)	271	121	48	41	49	58	53	63	45	53
Wafer (Rmb/W)	0.91	0.33	0.16	0.14	0.16	0.18	0.17	0.19	0.16	0.17
Cell (Rmb/W)	1.22	0.74	0.34	0.28	0.31	0.34	0.33	0.36	0.30	0.33
Module (Rmb/W)	1.93	1.41	0.80	0.68	0.72	0.78	0.75	0.79	0.71	0.75

ASP (incl. VAT)	1Q25	2Q25	3Q25e	4Q25e	Base case				Bull case				Bear case			
					1H26e	2H26e	1H27e	2H27e	1H26e	2H26e	1H27e	2H27e	1H26e	2H26e	1H27e	2H27e
Polysilicon (Rmb/kg)	39	38	40	45	47	50	55	60	50	55	60	65	45	45	50	55
Wafer (Rmb/W)	0.14	0.12	0.14	0.15	0.16	0.17	0.18	0.19	0.17	0.18	0.19	0.20	0.16	0.16	0.17	0.18
Cell (Rmb/W)	0.29	0.27	0.26	0.29	0.30	0.32	0.34	0.35	0.32	0.34	0.35	0.36	0.30	0.30	0.32	0.34
Module (Rmb/W)	0.68	0.68	0.67	0.70	0.71	0.73	0.76	0.79	0.73	0.76	0.79	0.80	0.71	0.71	0.73	0.76

Source: PVInfoLink, Morgan Stanley Research estimates

Exhibit90: Module unit gross profit assumptions - Scenario Analysis

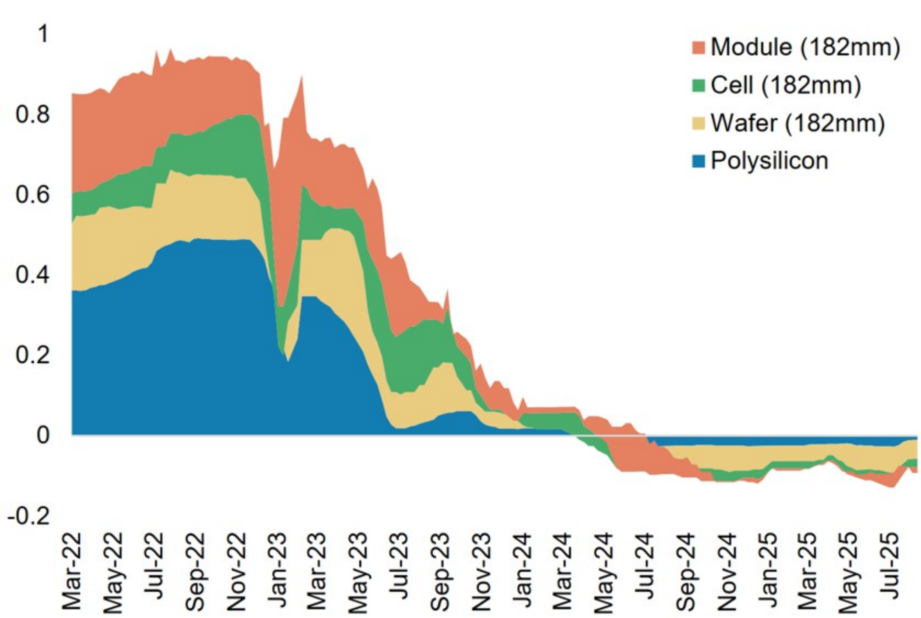
Integrated Module	2022	2023	2024	2025e	Base case 2026e	Base case 2027e	Bull case 2026e	Bull case 2027e	Bear case 2026e	Bear case 2027e
Polysilicon price (Rmb/kg, excl. VAT)	240	107	42	36	43	51	46	55	40	46
Poly consumption per W (g/W)	2.3	2.2	2.1	1.8	1.7	1.6	1.7	1.6	1.7	1.6
Silicon cost per W	0.55	0.24	0.09	0.06	0.07	0.08	0.08	0.09	0.07	0.08
Non-silicon cost per W	0.12	0.11	0.10	0.09	0.08	0.07	0.08	0.07	0.08	0.07
Wafer cost per W	0.67	0.34	0.19	0.16	0.16	0.16	0.16	0.16	0.15	0.15
Non-wafer cell cost per W	0.16	0.16	0.15	0.14	0.13	0.12	0.13	0.12	0.13	0.12
Non-cell module cost per W	0.44	0.40	0.37	0.35	0.34	0.33	0.34	0.33	0.34	0.33
Total module cost per W	1.27	0.90	0.70	0.65	0.63	0.61	0.64	0.62	0.62	0.60
Module ASP (Rmb/W, excl. VAT)	1.71	1.25	0.71	0.60	0.64	0.69	0.66	0.70	0.63	0.66
Unit gross profit (Rmb/W)	**0.44**	**0.35**	**0.01**	**(0.05)**	**0.01**	**0.08**	**0.02**	**0.09**	**0.005**	**0.06**
Gross profit margin (%)	**26%**	**28%**	**1.5%**	**-7%**	**1.3%**	**11%**	**4%**	**12%**	**0.7%**	**9%**

Integrated Module	1Q25	2Q25	3Q25e	4Q25e	Base case 1H26e	Base case 2H26e	Base case 1H27e	Base case 2H27e	Bull case 1H26e	Bull case 2H26e	Bull case 1H27e	Bull case 2H27e	Bear case 1H26e	Bear case 2H26e	Bear case 1H27e	Bear case 2H27e
Polysilicon price (Rmb/kg, excl. VAT)	35	34	36	40	42	44	49	53	44	49	53	58	40	40	44	49
Poly consumption per W (g/W)	1.8	1.8	1.8	1.8	1.7	1.7	1.6	1.6	1.7	1.7	1.6	1.6	1.7	1.7	1.6	1.6
Silicon cost per W	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.08	0.08	0.09	0.09	0.07	0.07	0.07	0.08
Non-silicon cost per W	0.09	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.08	0.08	0.07	0.07	0.08	0.08	0.07	0.07
Wafer cost per W	0.16	0.16	0.16	0.17	0.16	0.16	0.15	0.16	0.16	0.17	0.16	0.17	0.15	0.15	0.15	0.15
Non-wafer cell cost per W	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.13	0.13	0.12	0.12	0.13	0.13	0.12	0.12
Non-cell module cost per W	0.35	0.35	0.35	0.35	0.34	0.34	0.33	0.33	0.34	0.34	0.33	0.33	0.34	0.34	0.33	0.33
Total module cost per W	0.65	0.65	0.65	0.66	0.63	0.63	0.60	0.61	0.63	0.64	0.61	0.62	0.62	0.62	0.60	0.60
Module ASP (Rmb/W, excl. VAT)	0.60	0.60	0.59	0.62	0.63	0.65	0.67	0.70	0.65	0.67	0.70	0.71	0.63	0.63	0.65	0.67
Unit gross profit (Rmb/W)	**(0.04)**	**(0.05)**	**(0.06)**	**(0.04)**	**0.002**	**0.01**	**0.07**	**0.09**	**0.01**	**0.03**	**0.09**	**0.09**	**0.005**	**0.005**	**0.05**	**0.07**
Gross profit margin (%)	**-7%**	**-8%**	**-10%**	**-6%**	**0.2%**	**2%**	**10%**	**12%**	**2%**	**5%**	**12%**	**12%**	**0.7%**	**0.7%**	**8%**	**10%**

Source: PVInfoLink, Morgan Stanley Research estimates

Exhibit 91: Solar main value chain saw decent profitability in 2022 (especially given polysilicon's excessive profit) as a result of supply shortages; industry profitability deteriorated from 1H23 as new capacity was released

Unit gross profit breakdown among solar supply chain (Rmb/W)

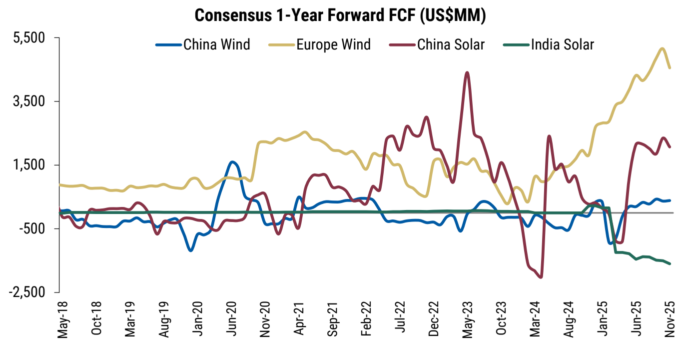


Source: PVInfoLink, Morgan Stanley Research

Street expects FCF inflection for equipment manufactures

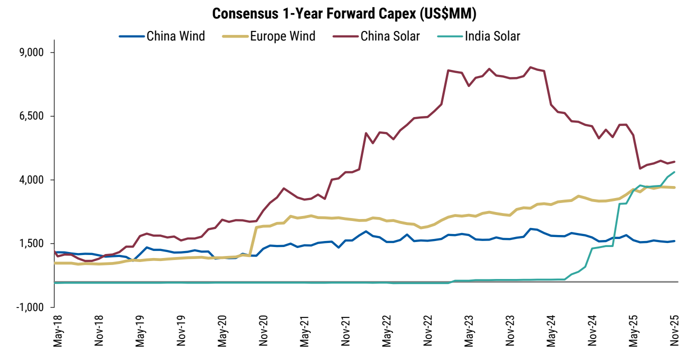
The Street expects wind and solar manufacturers to see an inflection in free cash flow in the coming years driven by lower capex and higher selling prices (Exhibit 92). China's anti-involution policies are driving supply chain rationalization as well as higher selling prices supportive of equipment manufacturers globally. The Street also expects solar supply chains in India to expand capex in the coming years (Exhibit 93), leveraging the higher selling prices and energy security concerns to drive new orders.

Exhibit 92: Street expects equipment manufacturers to see an inflection in FCF...



Source: Bloomberg, Morgan Stanley Research

Exhibit 93: With significant capex reductions in China while India expands capacity



Source: Bloomberg, Morgan Stanley Research

Supply Chain Diffusion is Accelerating

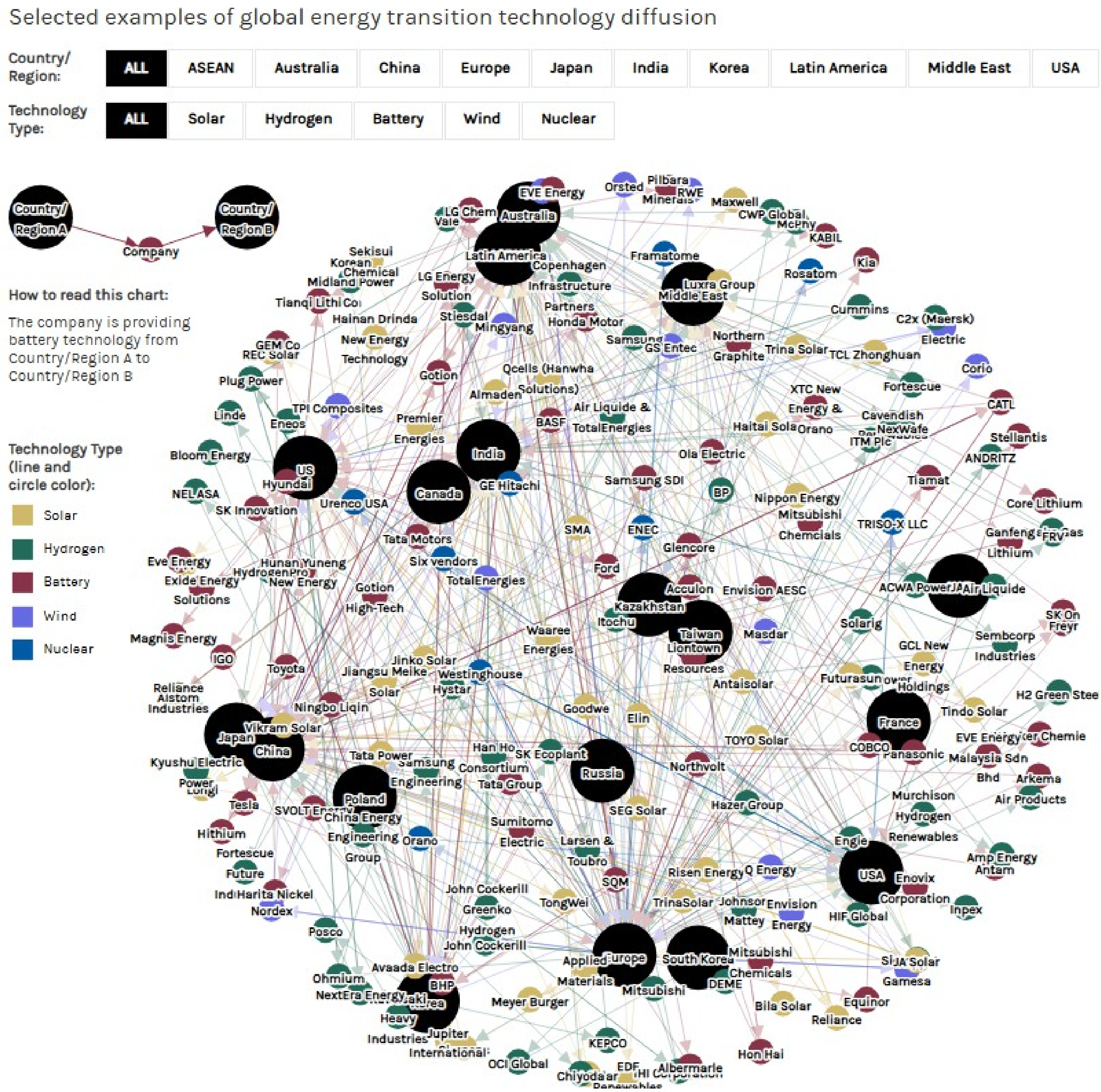
Investments in renewable equipment supply chains, whether modules, cells, wafers, wind turbines, etc, are showing up quite rapidly around the world. India, the US and Southeast Asia are in the midst of significant new supply in the next three years, especially to serve local markets. We have been surprised at the pace that new supply chain networks are being formed in domestic markets by international and local suppliers. The US has already seen 12GW of new module manufacturing facilities introduced; Reliance in India is bringing on 20GW of fully integrated solar panel manufacturing; China solar manufacturers are also expanding facilities in the Middle East; and India has seen an electrolyser ecosystem emerge with RIL also tying up with Nel Hydrogen for technology.

Reduced competition from China players driven by anti-involution policies will be supportive of global prices and protect new local supply chains. We see South Asia as being competitive with China once scale and local demand picks up. We are positive on companies like **Reliance** as it can take market share locally and also get government incentives to scale up.

We also note that solar value chains in key export destinations have built up quickly over the past year.

- **India:** Solar manufacturing capacity in India is surging, echoing the government's call in 2023 to reduce dependance on solar imports. As a result, MS India Utilities analyst, Girish Achhipalia, believes solar module manufacturing capacity reached ~74GW in March 2025 and expects it to reach ~100GW in India in 2026. This should be sufficient to supply domestic demand requirements of 40-42GW per annum in 2025-27. He also believes solar cell manufacturing capacity should be self-sufficient in 2026. This implies India would then only be dependent on importing the ingot/wafer stages. While there is demand upside potential in the India market, our global team sees this largely being sourced locally.
- **Europe and the Middle East & Africa** are also striving to achieve higher domestic solar manufacturing capacity. The Net-Zero Industry Act (NZIA), issued in Europe, aims to help with the development of the domestic solar chain, however we are seeing limited progress on reshoring to date. Middle East & Africa have also accumulated more than 20GW of solar manufacturing capacity, according to CPIA.
- **The US** has accumulated solar module assembly capacity of nearly 60GW with over 40GW planned/under construction, which we view as sufficient considering MS estimates 32GW of demand in 2025. This only represents the module assembly stage of manufacturing, and wafer and cell manufacturing capacity is much more limited in the US. We still expect a reliance on imports, particularly in solar cells, and we would note that the impact from the capacity buildup in the US on China solar exports is relatively limited considering the amount exported to the US through Southeast Asian countries is smaller than the amount exported to India and Europe. However, we believe it will still discourage some exports, dampen market sentiment and may pressure overall product prices.

Exhibit 94 Global Supply Chain Diffusion is Accelerating



Source: AlphaWise Web Intelligence, Morgan Stanley Research

US

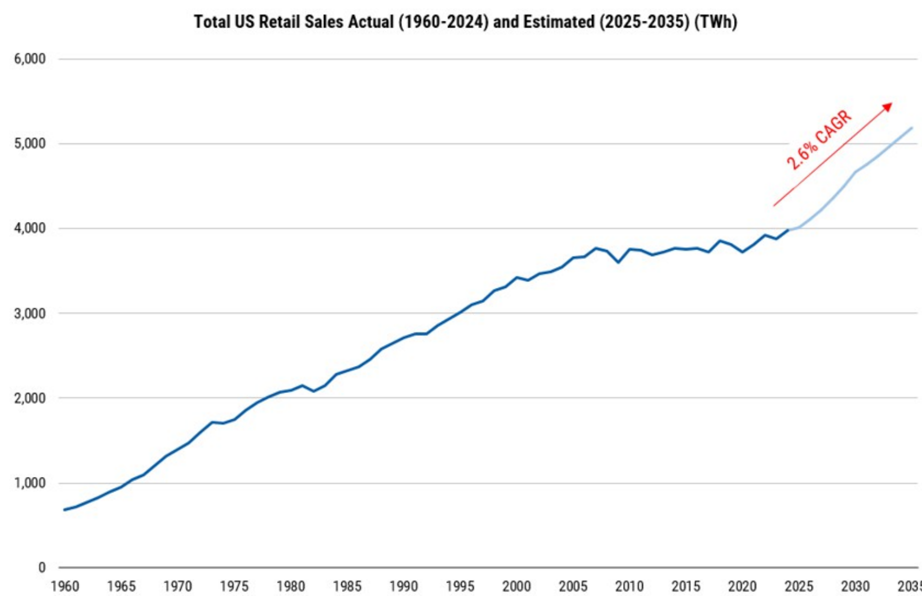
David Arcaro, Amanda Huang

We have reached an inflection point in US power demand. Over the past 20 years, power demand growth in the US has been relatively flat, growing at just a ~0.4% CAGR since 2005. The residential and commercial sectors saw slightly higher growth rates (~0.5% and ~0.6%) while industrial lagged.

Now, we see the landscape for power demand fundamentally changing in the near and medium term, accelerating at a ~2.6% CAGR through 2035, largely driven by data center growth, onshoring of manufacturing, and electrification (Exhibit 95). The increased load will require additional transmission and generation infrastructure to be built across the country as existing capacity gets filled.

Own the growth enablers. Electricity demand is growing faster than the utility industry is prepared to manage. We see a long runway in demand for renewables (NextEra: **NEE**, AES Corp: **AES**) and gas turbines (GE Vernova: **GEV**) over the next decade to power AI. And, as data centers stretch the capacity of the grid, existing power plants (Vistra Energy: **VST**, Talen Energy: **TLN**), small-scale solutions (Bloom Energy: **BE**), and grid operators building out additional transmission in high-demand areas (Sempra: **SRE**) become increasingly valuable to enable further growth.

Exhibit 95: Looking ahead, US electricity demand is set to inflect higher after decades of stagnation

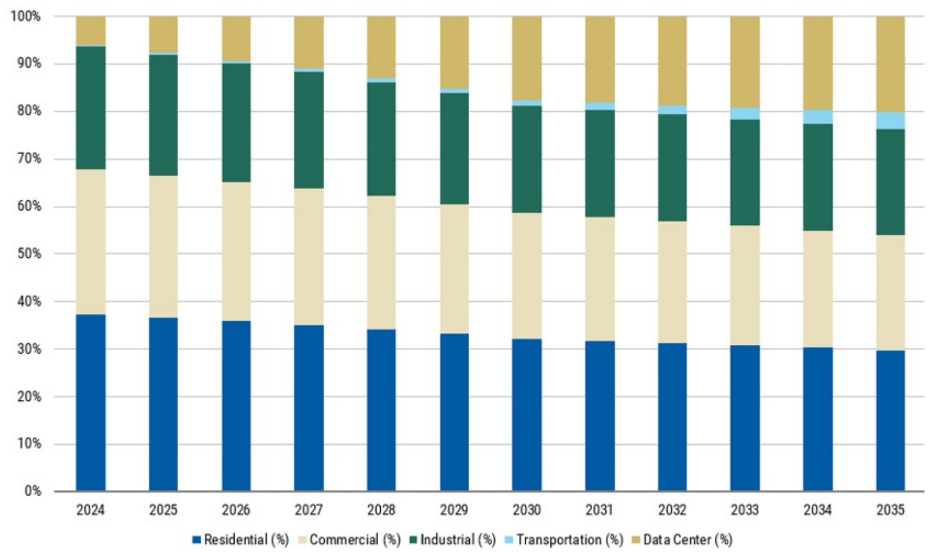


Source: EIA, Morgan Stanley Research estimates

Data centers will drive US power demand in the near term, making up ~78% of incremental load through 2030 and ~63% through 2035. Leveraging the work of Morgan Stanley analyst teams around the world, we estimate US GenAI power demand will grow at a ~125% CAGR in 2023-28, with overall US data center power demand growing at a ~30% CAGR in that same period (see Powering AI & Data centers below for additional details). With the substantial amount of load waiting to connect, we see a few solutions that could help meet part of the demand in the interim. After accommodating total power demand from data centers with non-grid-connected solutions, such as fuel cells and small-scale gas generation, and factoring in potential cryptocurrency mine conversions, we see data center demand growing to ~824,000 GWh by 2030 and ~1,050,000 GWh by 2035, or a ~13% CAGR over the next 10 years.

We see a case for data centers to take greater share of electricity demand, increasing from ~6% in 2024 to ~20% in 2035e. In 2024, electricity demand was primarily split between residential (~37%), commercial (~30%) and industrial (~26%) end users. In 2035, we expect increases in the relative composition for data centers (~20%) and transportation (~3%) and with declines in more traditional base demand of residential (~30%), commercial (~24%) and industrial (~22%). (Exhibit 96)

Exhibit 96: Data centers and transportation will take share of US electricity demand



Source: EIA, Morgan Stanley Research estimates

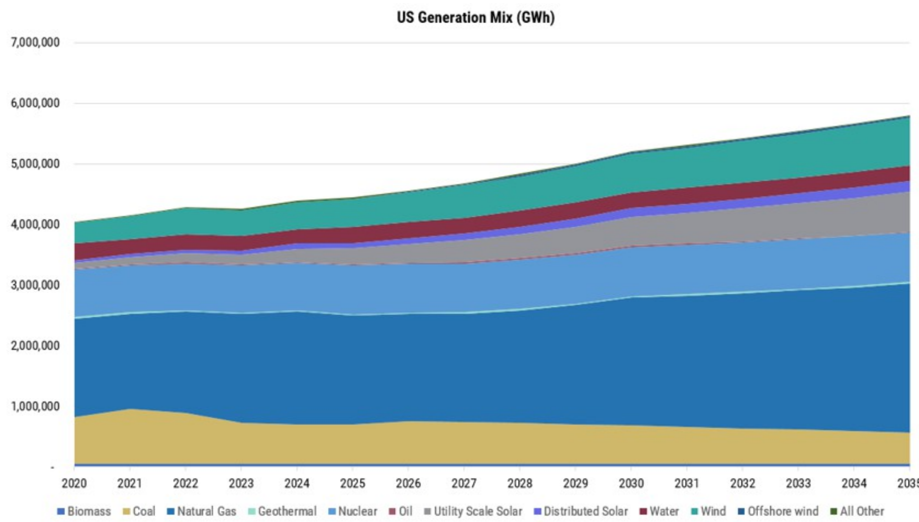
Renewables to make up majority of new assets. We think the power demand acceleration will require a substantial amount of new power generation, which will require a portfolio approach of new gas and renewables. On average over the next 10 years, we think wind and solar assets will make up ~70% of new builds (533GW vs. 781GW of total capacity addition), growing to ~38% of US installed base from just 17% in 2020. Gas assets (135GW) make up the majority of the rest of new generation assets, and we would also expect battery storage installations to grow at a ~5% CAGR through 2035, and reaching ~13% of installed capacity by 2035 from <1% in 2020. (Exhibit 97)

Overall, we would consider the OBBBA to be better than expected for most subsectors within the renewables space. Tax credits remain in place for large-scale wind and solar through mid-2030 (considering safe harbor) for all projects that started construction prior to the bill being passed and for those that start through mid-2026. Battery storage policy was also much better than feared, with tax credits available through 2033 before stepping down. In all instances, and even in the absence of renewables tax credits, wind and solar are at least on par with new gas generation economics (we estimate in the US$75-90/MWh range), if not better.

We also expect an acceleration in gas generation, growing to ~2,500,000 GWh in 2035,

~42% of supply (from 40% today). We would also expect gas plants to run at higher capacity factors to help support increasing power demand. Following, we expect renewables assets to take share in generation, growing to ~28% of total supply (from ~20% today), and we would expect decreasing relative contributions from energy sources, such as coal and oil, as those assets continue to age and become non-economic to run.

Exhibit 97: Base Case Generation Mix (GWh)

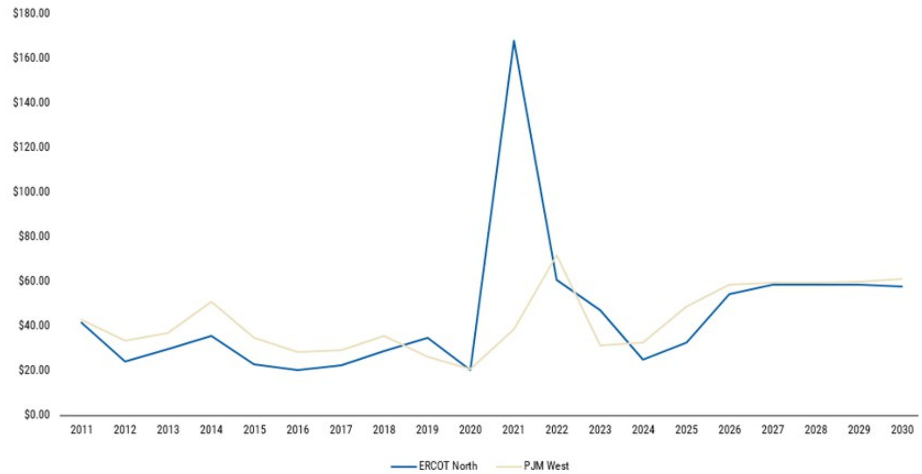


Source: EIA, Morgan Stanley Research estimates

In terms of the power markets, forward prices are beginning to rise, but we think there is room for even higher prices given the significant increase in load growth. YTD, power prices for 2026 are up modestly in ERCOT (+4.3% ATC ERCOT Houston) and PJM (+14.1% ATC PJM West and +10.9% PJM East). Spark spreads have been mixed for 2026 YTD (-1.9% ERCOT Houston, +16.6% PJM West, +11.4% PJM East). YTD, power prices for 2027 are up substantially in ERCOT (+10.0% ATC ERCOT Houston) and up modestly in PJM (+8.8% ATC PJM West and +4.0% ATC PJM East). Spark spreads are also up – +7.0% ERCOT Houston, +8.7% PJM West, and +0.7% PJM East. We think this outlook could further improve as data center plans crystallize and we see additional load being added to forecasts and considered more formally. (Exhibit 98)

Absolute levels look too low to us – We estimate new combined cycle gas plants will be needed, and would require ~US$75-90/MWh around the clock pricing. ERCOT prices in the low US$50s/MWh and PJM prices in the mid US$60s-70s/MWh (including capacity revenue) are not high enough to drive activity, in our view.

Exhibit 98: Forward ATC prices show upwards inflection in 2025-2027



Source: Prices as at 11/7/2025. Source: Morgan Stanley Research

How much could power prices rise based on increased load? There are many factors that influence this analysis, but we separate these into the impact to daily pricing from greater power usage year-round and the impact to peak load and scarcity events. Looking back over the past two years, we analyzed the actual change in power price for every 1GW in higher load in ERCOT. On a weighted-average basis when stacking up prices against the load levels, power prices increased by US$3/MWh for every 1GW higher load over this period. This compares to 2026 around-the-clock power prices of US$50-55/MWh for ERCOT North, so the impact of a 1GW increase in load could increase power prices by +5-6% based on this analysis.

Europe

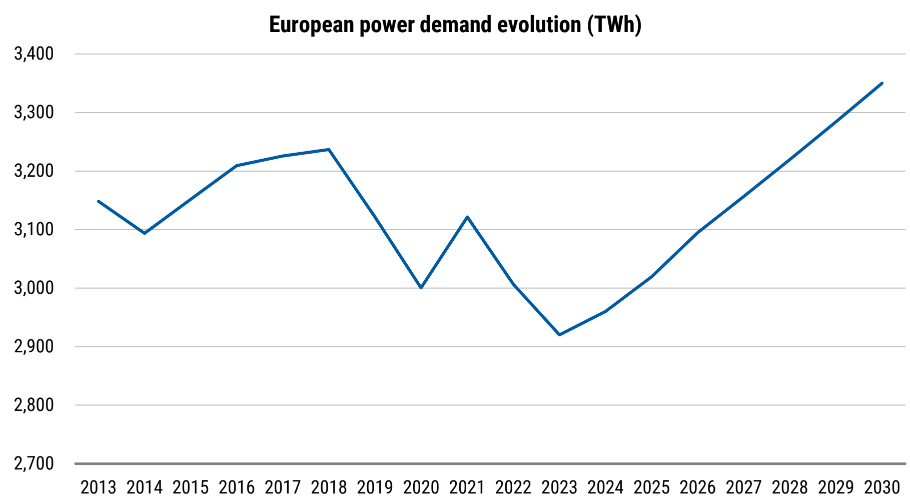
Robert Pulleyn, Arthur Sitbon

European power demand is at an inflection point, in our view

European power demand has been coming down over the past few years, at a pace of -1.5% CAGR over 2018-24 (-275 TWh), driven by demand destruction (first during Covid and then, and mainly, in the context of the 2022-23 energy crisis, with high power prices) and energy efficiency.

We expect a rebound in the coming years - we forecast a 2024-30 gross power demand CAGR of 2.1% or 390TWh in total growth (Exhibit 99). This implies that Europe regains the lost power consumption of 2022-23 by 2027.

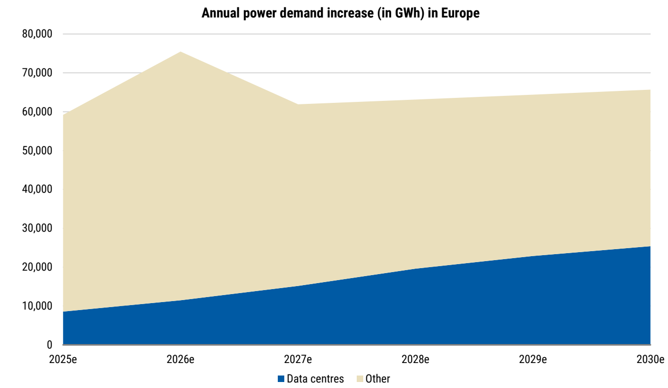
Exhibit 99: We expect a rebound in European power demand in coming years



Source: ENTSO-E, Morgan Stanley Research estimates

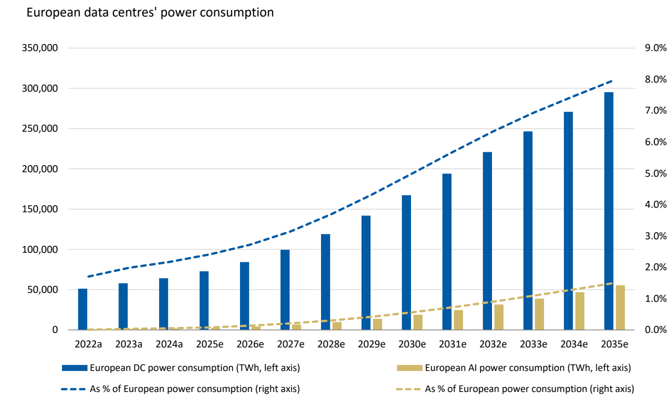
Data centres will play a significant role in the rebound in European power demand. We expect data centre-related power demand to contribute ~30% to the 2026-30 growth profile (Exhibit 100). For more detail on our views on the increase of power demand from data centres and the broader theme of the European data centres market growth, please see: Global Infra, Tech, Utilities & Renewables, Cap Goods, Construction, Real Estate: Global Data Center Capacity Growth to Increase 6x (15 Jul 2025).

Exhibit 100: We expect data centres to contribute to ~30% of European power demand growth in 2026-30e



Source: Morgan Stanley Research estimates

Exhibit 101: Overall, we expect data centres to account for ~5% of European power demand by 2030e (vs. ~2% currently)



Source: ENTSOE,Morgan Stanley Research estimates

Together with data centres, we also expect broader economy electrification (heat pumps, EVs) as well as potential industrial recovery (as power prices have partly normalised post energy crisis) to contribute to a better power demand outlook in Europe for coming years.

Our recent survey has suggested more supportive signals for European industry's power demand outlook than we anticipated. On average, European companies surveyed (across several sectors: Chemicals & Materials, Mining, Autos, Construction and Capital Goods) expect power demand to increase by 7.3% over the next 3 years, with 83% expecting to see growth. While this is lower than in the US (8.1% and 88%, respectively), this is better than we expected and than broader market expectations, we believe. For more detail on our survey regarding industrial power demand, please see Future of Energy: Europe vs US Energy Face-Off (31 Oct 2025).

We acknowledge that the thesis on rising power demand is not evident yet in 2025. After a small 2024 rebound from 2023 lows (+1.4%), 2025 looks largely lacklustre across Europe, with YTD demand flattish YoY (+0.3%) - see Exhibit 102 . However, within this we see pockets of demand growth, notably in Iberia, with Portugal & Spain +2-3% YoY. This was emphasized in 3Q results for Endesa, which highlighted power demand +4% YoY in its operating areas and +9% in the Aragon region, driven by data centres. Endesa also sees rebounding industrial power demand at +2.4% YoY, while Fortum also referred to a rise in PPA discussions in Scandinavia on its 3Q results conference call. We expect a non-linear acceleration in data centre power demand and electrification trends, with the former stepping up the pace of growth from 2027 onwards.

Exhibit 102: European power demand has been flattish YoY in 2025

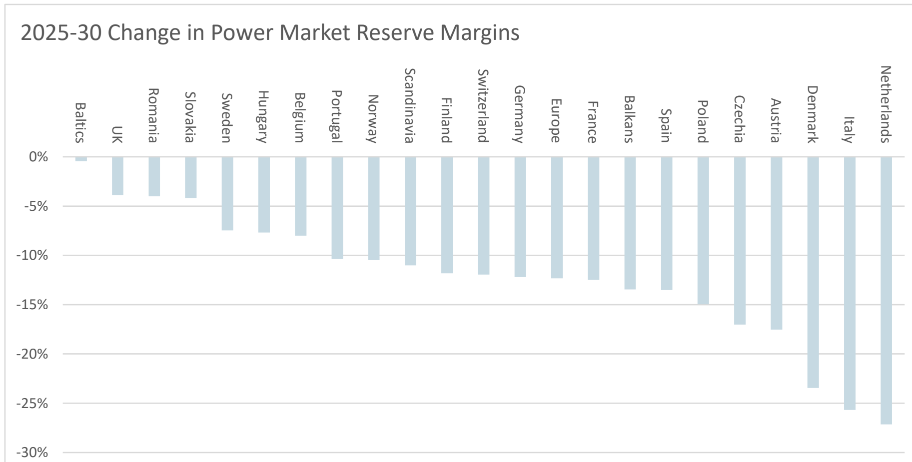
		Generation Volumes								
YTD (% YoY)	Demand	Hydro	Wind	Solar	Gas	HDD	Wind Speed	Gas Storage	Precipitation	Reservoirs
Austria	1%	-24%	-7%	-2%	67%	11.3	-8%	-19%	-65%	-15%
Czechia	2%	-17%	-19%	20%	17%	13.0	-6%	-16%	-48%	
France	2%	-19%	54%	31%	1%	1.9	-2%	-8%	-45%	-22%
Germany	1%	-13%	-4%	17%	12%	8.9	-6%	-28%	-26%	
Italy	-1%	-19%	5%	22%	4%	2.0	0%	-9%	-58%	-20%
Portugal	3%	-6%	-6%	28%	74%	1.5	-2%	-2%	-38%	-8%
Spain	2%	-2%	-9%	12%	34%	1.6	-6%	-15%	-34%	-7%
UK	-1%	-15%	-20%	32%	14%	-0.4	-18%	-20%	-42%	
EU	**0.3%**	**-16%**	**3%**	**17%**	**15%**			**-12%**		

Source: ENTSO-E, GIE, Bloomberg, Morgan Stanley Research. Note: 1. Gas storage is end-of-month, 2. Hydro reservoir level is most recent weekly data, 3. "Long-term" refers to the average since 2018 for power generation, since 2010 for gas storage, and since 1970 for weather data. The difference is due to varying data quality and consistency for longer-term horizons.

Potential rebound in power demand to be supportive for European power prices

We expect rising power demand to exacerbate tight European power markets, where the net closure of coal and nuclear is reducing baseload power generation capacity and also increasing weather reliance. Our bottom-up European power model shows 316GW of net power generation capacity additions in 2025-30 (up from 249GW for the prior 6-year period of 2019-24). To the end of the decade, we see a 3.6GW net reduction in nuclear, coal closures of 49GW, a 7.4GW net increase in gas and 360GW of net growth in wind & solar capacity.

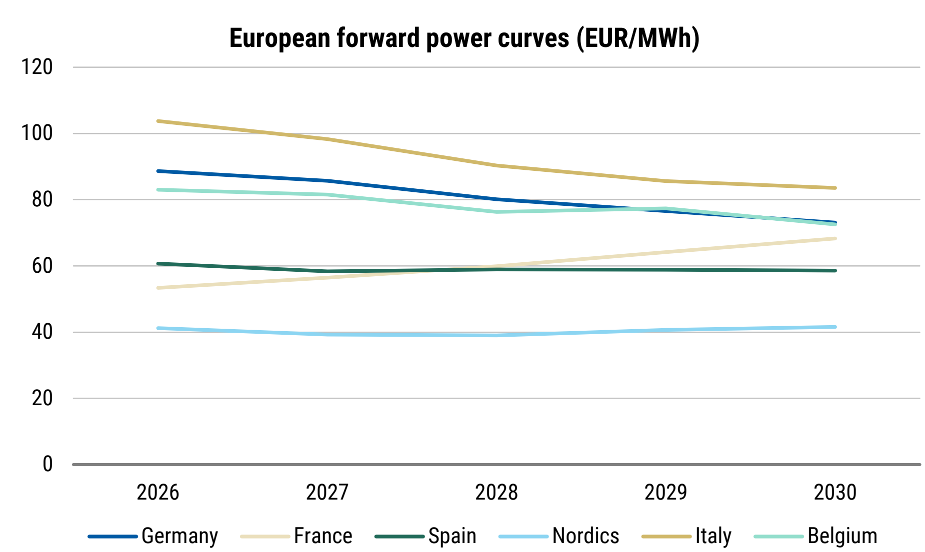
Exhibit 103: We see power reserve margins declining across Europe in coming years



Source: Morgan Stanley Research estimates

European forward power curve is still in backwardation, reflecting a backwardated forward gas curve (-€7/MWh between 2026 forward and 2030 forward in TTF gas prices), but also a skeptical market view on potential upcoming power demand rebound.

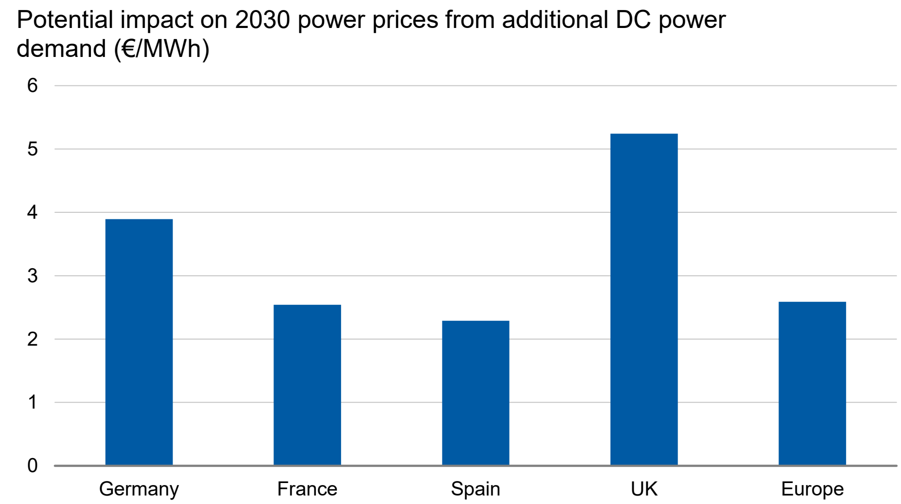
Exhibit 104: Forward power curves are still in backwardation in most European markets



Source: OMIP, PXE

We estimate that additional power demand to 2030 from data centres alone could lead to a €3/MWh increase on European power prices - all else kept equal (compared to a scenario of flat data centre power demand), with a more significant impact in the UK and in Germany - see Exhibit 105 . This would represent a ~4% tailwind to European power prices. Taken in its entirety, the increase in European power demand between 2024 and 2030 could account for - all else kept equal - a ~€10/MWh tailwind to European power prices compared to a scenario without any demand growth.

Exhibit 105: We estimate that additional power demand to 2030 from data centres alone could lead to a €3/MWh increase on European power prices - all else kept equal (compared to a scenario of flat data centres power demand)



Source: Morgan Stanley Research estimates

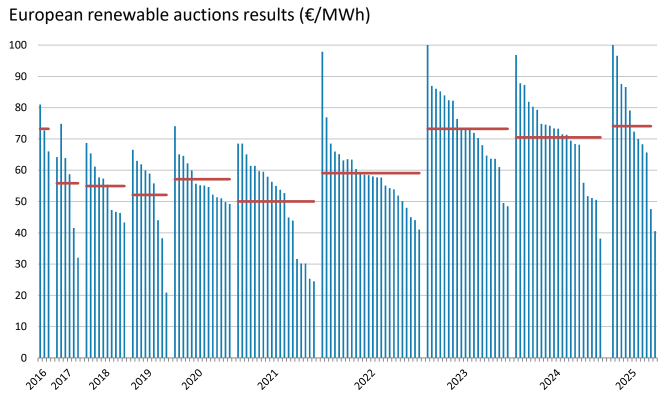
Expect further renewables build-out

We expect wind & solar to account for >90% of Europe's gross power generation capacity additions over 2025-30e (362GW out of 394GW total additions). Given a significant share of that is aimed at offsetting capacity closures (-89GW of which most had the capacity to operate baseload), upside surprises to power demand would most likely require incremental additions versus current expectations.

We continue to see government auctions driving the rising penetration of renewables in Europe, with auction prices that have stabilised at >€70/MWh, allowing good enough returns on future projects.

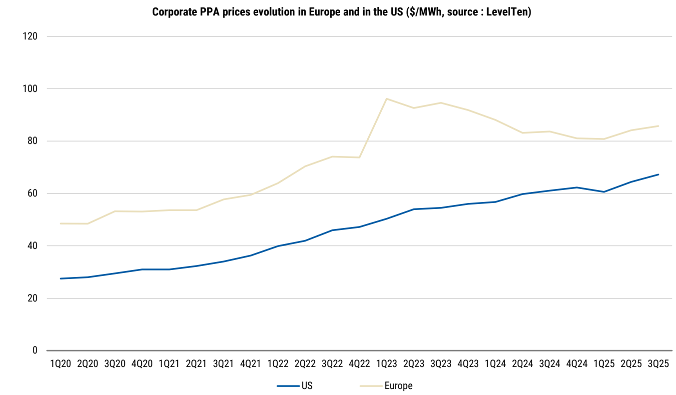
And we also see rising appetite from private players to sign corporate PPAs as explained in Utilities: The Overlooked Value of Power (10 Oct 2024).

Exhibit 106: We continue to see government auctions driving the rising penetration of renewables in Europe - auction prices have stabilised at a reasonable level in Europe



Source: Various sources, Morgan Stanley Research

Exhibit 107: And corporate PPA prices have also stabilised at a good level to incentivise new projects



Source: LevelTen, Morgan Stanley Research

Strong focus on power system flexibility & resilience - acceleration in grid investments, nuclear renaissance, rise of batteries & reliance on CCGTs

In a scenario in which power demand accelerates faster than we model, we think additional renewables capacity will be required, but also new flexgen to balance the weather risk – through new combined cycle gas turbines (CCGT), as we are seeing proposed in Germany. We could also see more nuclear life extension announcements ahead, notably in Spain and the UK.

Further nuclear life extension and new CCGT build-outs could represent new revenue opportunities for some European utilities.

- The new CCGT investment opportunity seems most relevant to RWE in our sector.
- Nuclear life extension should benefit Engie in Belgium, and could lead to revenues for longer at Spanish utilities, including Endesa.

In the meantime, flexible assets should be able to benefit from attractive market conditions, via high spreads and/or good additional sources of revenues (e.g., capacity remuneration, ancillary services).

A rise in battery installations could also represent a new investment opportunity for companies in the sector.

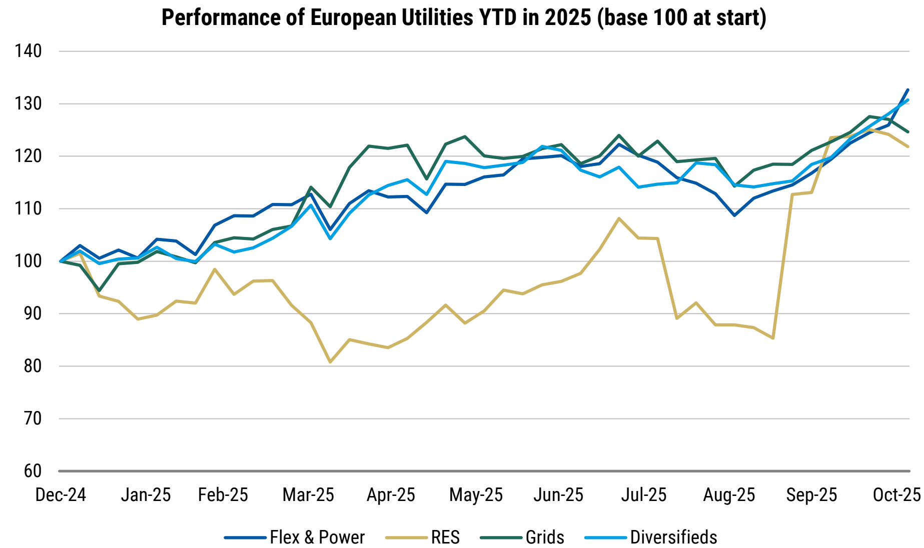
How to play the theme?

The theme of the changing nature of the European power system can be played via four different sub-segments in our view: Flex & Power, Renewables, Grids and Diversifieds. These four segments have performed strongly YTD in 2025 (+22-33%), reflecting the market has started to acknowledge their rising value - see Exhibit 108 .

- Power & flexibility names have performed strongly, but we still see some good opportunities. We favour Engie, RWE & Centrica, all three Overweight-rated.

- In Renewables, given high valuation levels & weaker fundamentals in some markets, we now have a more selective/cautious view. We prefer playing the theme via RWE.
- In Grids, we like Elia, National Grid & Redeia.
- In Diversifieds, SSE & A2A are our two favourite names. Iberdrola is usually perceived as the leader in this sub-segment, but we see better relative valuation elsewhere.

Exhibit 108: Flex & Power, Renewables, Grids and Diversified names have performed very strongly YTD



Source: Datastream,Morgan Stanley Research

Latin America

Fernando P Amaral, Bruno Oyamata

In LatAm, power markets vary materially across countries. Brazil faces the largest oversupply, while Argentina, Chile and Mexico face tighter supply x demand. Electricity demand growth linked to data centers represents a major potential driver, though it has yet to be unlocked.

BRAZIL

Brazil's power system remains oversupplied as capacity growth outpaced demand. Sizable incentives given to renewables over the past few years have led to a ~30% oversupply, reflected in low power prices, which has persisted below the levelized cost of electricity (LCOE) since around 2022. The matrix is facing structural shifts as the rapid expansion of intermittent generation added complexity to a historical hydro-thermal power system. Solar duck curves, higher volatility in spot prices and curtailment are the main side effects. However, the need for capacity reliability continues to grow, particularly to compensate for the sharp drop in solar generation during late afternoon. Planning authorities have already begun to raise requirements for reserve capacity that can offer flexibility throughout the day. In fact, the system operator (ONS) has recommended holding annual auctions to contract firm capacity, and the government has already scheduled regulated auctions - expected in March 2026 - to secure supply from thermal (natural gas, coal, and biodiesel) and hydroelectric sources.

On the demand side, planning authorities project that electricity consumption will grow at a 4.3% CAGR through 2029. According to the Technical Note on Electricity Demand Projections for the National Interconnected System 2025-2029 (here), prepared by the Energy Research Company (EPE), the system operator (ONS), and the electricity chamber (CCEE), total consumption is expected to reach ~693 TWh by 2029 - an 18% increase compared to 2025. Notably, this latest projection represents an upward revision relative to the previous Technical Note, which estimated a 3.6% CAGR. The adjustment is primarily attributed to updated macroeconomic forecasts, climate effects, and accelerated growth in distributed generation.

ARGENTINA, CHILE & MEXICO

Argentina and Mexico face a relatively tight supply-demand balance due to years of underinvestment. Policy and regulatory uncertainties in both countries - combined with Argentina's challenging macroeconomic environment - have heightened risks of power deficits, particularly during peak demand periods. Mexico is pursuing an ambitious energy plan to expand generation capacity through a mix of state-led investments (via CFE and PEMEX) and private participation (see Mexico: Power Is Key for a New Era). In Argentina, the new administration is advancing comprehensive power sector reforms to address legacy issues, reduce subsidies, correct structural distortions (such as weak price signals), and attract investment through regulated auctions and greater private sector competition (see Argentina: Rebuilding the Power Industry). On the demand side, Mexico's Ministry of Energy projects power demand to grow at a 2.3% CAGR from 2025 to 2029. In contrast, Argentina has yet to publish a medium- to long-term energy plan, amid a volatile - though gradually improving - macroeconomic environment.

Chile's energy mix is undergoing a major transition, driven by rapid renewable expansion and the planned shutdown of coal-fired power plants. The country's ambitious energy transition plan includes: i) the gradual phase-out of all the country's coal-fired capacity by 2040, which amounted to ~5GW or ~19% of the power matrix in 2020; and ii) renewable expansion, with the target to achieve 80% penetration by 2030 (vs ~68% in 2024). On the demand side, Chile's National Energy Commission (CNE) projects electricity consumption to grow at a 2.2% CAGR from 2025 through 2029, reaching ~89 TWh.

Middle East

Ricardo Rezende

The electricity landscape in the GCC (Gulf Cooperation Council) countries is being significantly re-shaped from both a supply and a demand perspective. Power demand in the region is supported by multiple macro tailwinds. The aim to grow the non-oil part of the economy is a common theme across countries, that should support economic growth and industrial development. Population growth and tourism are also other factors that showed continued momentum in the recent past, and should remain relevant looking forward. Electricity demand per capita is already high in the region, but we believe these factors should support solid demand growth in the medium to long term.

The power sector has a significant role in all the strategic government plans outlined over the years across the GCC. All countries are trying to increase the share of renewables in the energy mix. Saudi Arabia stands out as the country with the most ambitious target, planning to reach up to 130GW in renewables capacity by 2030. Renewables are expected to represent 50% of the energy mix by then. The Kingdom also anticipates an increase in gas-fueled plants, with the aim of displacing liquids and freeing up products for export (oil still represented 34.5% of electricity generation in 2024). Solar tends to be the preferred technology in the region, considering it has one of the highest solar potential globally. However, the UAE has also developed 5.6GW in nuclear power capacity through the Barakah nuclear plant, with the last reactor completed in 2024. The plant generated 39TWh in 2024, representing ~37% of electricity generation in Abu Dhabi and the Northern Emirates.

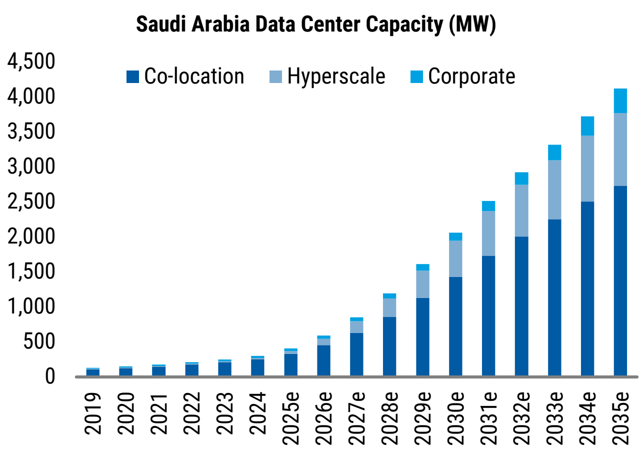
Significant growth in data center capacity, as discussed by our global research team (Global Data Center Capacity Growth to Increase 6x), could also further boost power demand in the region. Saudi Arabia aims to reach 1.9GW in capacity by 2030 and further accelerate to 6.6GW by 2034, with the MS global team seeing a 13x growth in capacity in KSA over the coming decade (Exhibit 109). Data center capacity in the UAE should reach even higher levels by mid-2030s. In addition to other projects, the UAE is planning to develop a 5GW AI campus through a partnership with multiple US tech firms (e.g. Open AI, Oracle), the first 200MW is projected to come online next year. (Exhibit 110)

We list below the main targets and projections across countries in the GCC:

- **Saudi Arabia:** The Kingdom has raised its renewables target multiple times over the years, now expecting 100-130GW in renewables capacity by 2030 (Exhibit 111), depending on electricity demand. SPPC (Saudi Power Procurement Company) is expected to tender an average of ~20GW annually, starting in 2024, to reach this target. Renewables are projected to represent 50% of the energy mix by 2030. Saudi Arabia also aims to displace liquids from its generation system, which should free up products for exports and lower carbon emissions. As such, an increase in gas-powered plants is expected, to both replace liquid fuels and meet growing power demand. Saudi Aramco plans to increase its gas production capacity by 80% by 2030 (from 2021 levels).

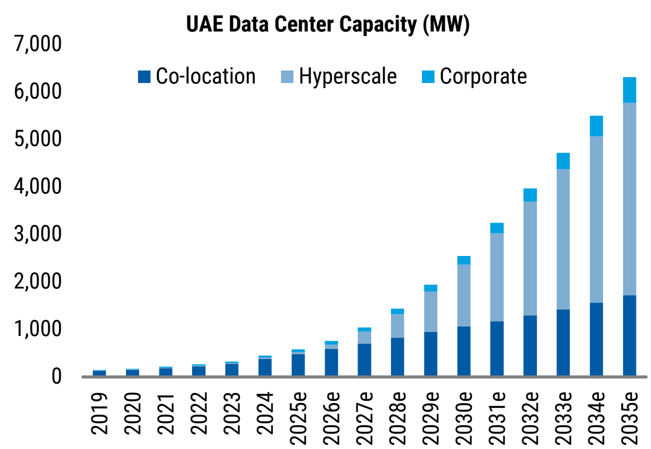
- **UAE:** At the federal level, the UAE plans to have ~32% of power generation by clean sources by 2030, with an expected renewables capacity of 19.8GW. The emirates also have their own domestic strategies: **i) Abu Dhabi & Northern Emirates:** The government of Abu Dhabi plans that by 2035 nuclear should represent 40% of the energy mix, while renewables should account for 20% of the total. The fourth reactor of the Barakah nuclear plant came online in 2024, with total capacity standing at 5.6GW. The Emirates Water and Electricity Company (EWEC) sees power demand growing at ~5% annually in 2024-2035; **ii) Dubai:** DEWA raised the target for its flagship renewable project, the Mohammed bin Rashid Solar Park, to 7.3GW by 2030 (the original plan was 5GW), which should represent 34% of total power capacity (22GW total installed capacity by 2030).
- **Qatar:** Renewables capacity is expected by regulators to be 4GW by 2030, which should represent 18% of the power mix. The government projects electricity demand of 80TWh by 2040 (58.6TWh in 2024).
- **Oman:** Oman's Vision 2040 targets a 30% share for renewables in the energy mix by 2030. As of 2024, most of its electricity was produced through gas (44.8TWh out of 49.1TWh in total).
- **Kuwait:** The Ministry of Energy announced that renewables should represent 30% of the energy mix for Kuwait by 2030. Renewables capacity should reach 22.1GW in 2030, growing significantly from 2024 levels (~110MW).
- **Bahrain:** The government set a target for renewables to represent 20% of peak load demand by 2035, increased from the previous target of 10%.

Exhibit 109: Data center capacity in Saudi Arabia is expected to rise by 13x over the coming decade



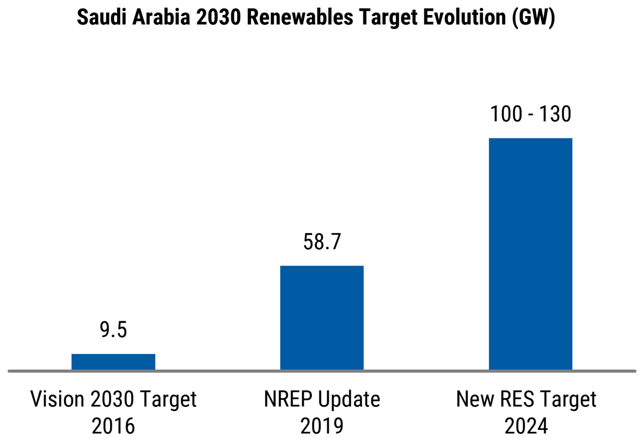
Source: Morgan Stanley Research estimates.

Exhibit 110: The UAE should also deliver strong capacity growth, driven by Stargate UAE



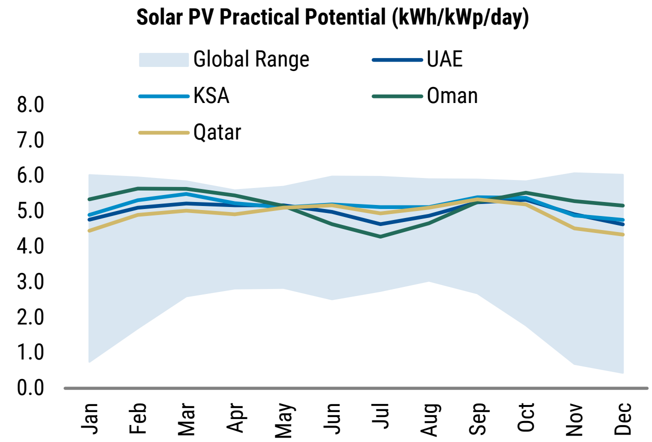
Source: Morgan Stanley Research estimates.

Exhibit 111: Saudi Arabia increased its renewables target multiple times, currently expecting up to 130GW by 2030



Source: Ministry of Energy, SPPC, NREP, Morgan Stanley Research.

Exhibit 112: GCC countries are among those with the highest solar potential globally



Source: World Bank Group, Morgan Stanley Research.

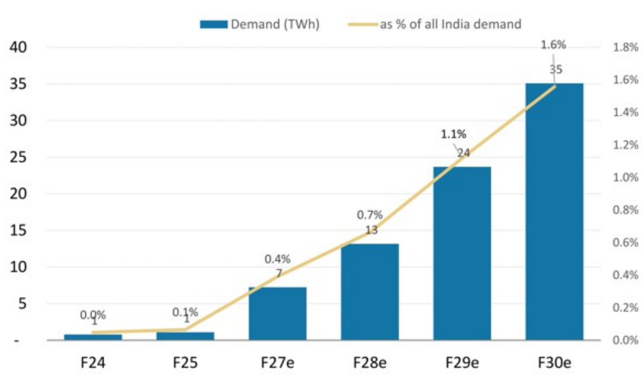
India

Girish Achhipalia, Amit Bhinde

Weather-led negative impact in near term, tailwinds strengthening for medium term. India power demand has remained flat yoy in F26YTD (Apr-Oct-25) despite a lower base, mainly impacted by an extended monsoon season and now the India Meteorological Department (IMD) forecasts a colder winter due to La Nina (link). On the positive side, the new consumption avenues of data centers, EV penetration, announcements on semiconductor manufacturing etc, continue to rise. Also the existing consumption avenues of manufacturing and infra-led investments remain robust. Despite, the weaker demand in F26, we continue to expect India's medium-term power demand (F26-31e) to grow at a 7% CAGR (at ~1.1x GDP).

Storage gaining traction: Over the past two years, India's government has accelerated its push on storage adoption with a large number of pumped storage projects being add to the survey and investigation stage, batteries are being made compulsory in plain solar contracts (solar projects to compulsorily have 10% BESS) and there has been an increase in standalone BESS project tenders. The government is also attempting to move peak demand from non-solar hours to solar hours, to mitigate the evening peak challenges. The divergence of renewable capacity towards charging batteries, and the losses on round trip efficiency, should in turn lead to increased dependence on thermal generation to meet rising demand.

Exhibit 113: All India power demand and incremental demand from data centers

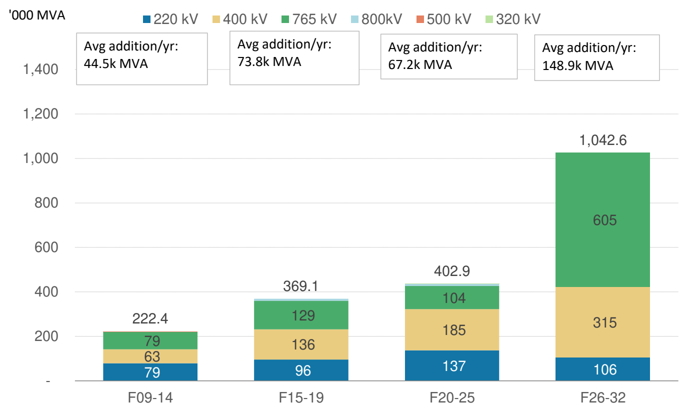


Source: CEA, e = Morgan Stanley Research estimates

Data centers expected to add ~1.6% to India's power demand by F30e: We expect India's data center capacity to expand to ~9GW by F30 (F25: 1.3GW) with large corporates announcing capacity additions plans. As of Oct-25, the Ministry of Power has received proposals for connectivity of 5.64GW of data center capacity by F32e, a large part of which is concentrated in Tamil Nadu. We estimate this would add about 35TWh to electricity requirements (at 50% utilization rate) forming ~1.6% of India's overall power demand).

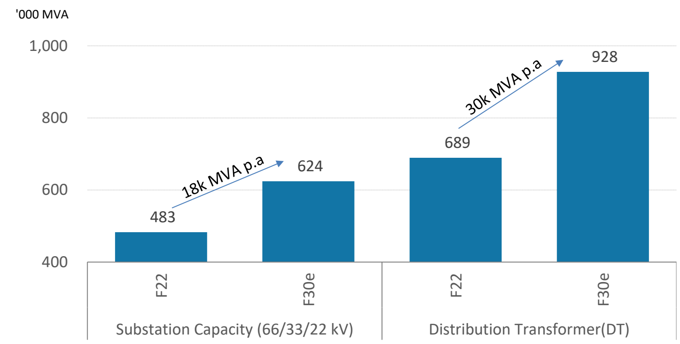
Sizable increase in transmission network: The National Electricity Plan (NEP) pegs transmission capex at Rs9.2trn over F23-32 (Rs4.25trn in F23-27, and Rs4.9trn in F28-32). Interstate capex is pegged at Rs6.6trn, while the balance (Rs2.6trn) is for intra-state. The NEP assumes peak demand of 296GW by F27, and 388GW by F32, respectively. As per the plan, the government targets to add 1,240GVA of non-HVDC transformation capacity (120% growth over F22 levels) and 33,250MW of HVDC transformation capacity over F23-32 (100% growth over F22 levels).

Exhibit 114: India's power transformer capacity addition plan, F22-32e



Source: National Electricity Plan (NEP), CEA, Morgan Stanley Research. Note: F26-32 as per NEP.

Exhibit 115: India's distribution transformer capacity addition plan, F22-30e



Source: CEA, Morgan Stanley Research. e = government plan.

Japan

Reiji Ogino

We expect demand for electricity in Japan to increase over the long term, driven by the construction of new AI data centers and semiconductor factories. According to the Japanese government's 7th Strategic Energy Plan, electricity generation in FY2040 is projected to be around 1.1–1.2trn kWh (1,100-1,200TWh). This represents an increase from the preliminary FY2023 figure of 985.4bn kWh (985.4TWh).

The Japanese government aims to raise the share of renewable energy and nuclear power in the energy mix over the long term. Exhibit 116 shows the projected breakdown of electricity output in FY2040 under the 7th Strategic Energy Plan. The government's targets for FY2040 include increasing the share of nuclear power to around 20% (preliminary FY2023 result: 8.5%) and the share of renewable energy to around 40-50% (22.9%). As shown in Exhibit 117, among major renewables, solar and wind power (especially offshore wind) are attracting attention.

We see a risk that, over the long term, the construction of new renewable energy or nuclear power facilities could face delays. Under such a scenario, we believe the Japanese government could increase the amount of electricity generated by gas-fired power plants.

Exhibit 116: Outlook on breakdown of electricity output

	F3/24 (Preliminary figures)	F3/41e
Renewables	22.9%	Approx. 40-50%
Nuclear	8.5%	Approx. 20%
Thermal	68.6%	Approx. 30-40%

Source: METI, Morgan Stanley Research; e = METI outlook

Exhibit 117: Outlook on breakdown of renewables in energy mix

	F3/24 (Preliminary figures)	F3/41e
Renewables	**22.9%**	**Approx. 40-50%**
Solar power	9.8%	Approx. 23-29%
Wind power	1.1%	Approx. 4-8%
Hydro	7.6%	Approx. 8-10%
Geothermal	0.3%	Approx. 1-2%
Biomass	4.1%	Approx. 5-6%

Source: METI, Morgan Stanley Research; e = METI outlook

Australia

Rob Koh, Samantha Edie

Demand. We forecast Australia's power demand to grow at ~1%pa over the next few years after a decade of declines. We see net growth from population growth and economic activity, including data centres, offsetting rooftop solar production and energy efficiency, but we do consider scenarios where aluminium smelters close (e.g., Tomago, Bell Bay), which would offset the growth (as it did in the previous decade).

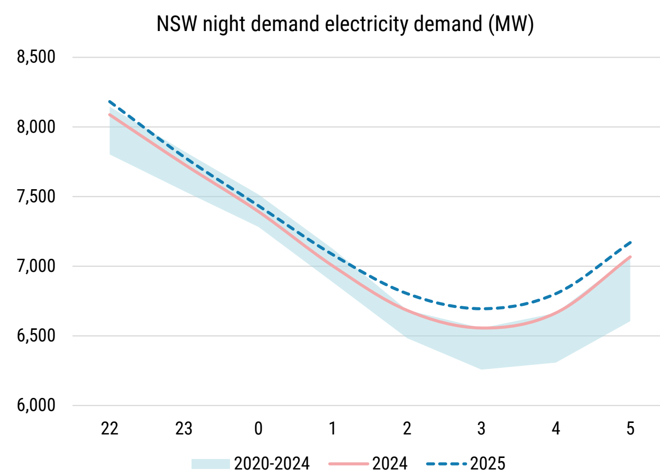
- NEM demand is +3% FYTD vs. pcp, and night demand (proxy for data centre growth) is +96MW in New South Wales (NSW) YoY and +170MW in Victoria.
- We think that if aluminium smelters were to close, e.g., Tomago Smelter (~8TWh, ~10% of NSW demand), it should help accelerate the end of coal power stations, e,g., Eraring.

Exhibit 118: National Electricity Market (NEM) operational demand

TWh	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%Δ
1999	13.0	12.2	13.2	12.5	13.8	14.2	14.7	14.4	13.3	13.5	13.2	13.5	161.6	
2000	13.6	13.8	14.3	13.1	14.6	15.1	15.4	15.1	13.7	14.0	13.7	14.1	170.4	5.5%
2001	14.8	13.8	14.6	13.5	14.9	14.9	15.6	15.4	14.0	14.3	13.9	14.2	174.0	2.1%
2002	14.7	13.7	14.7	14.0	15.1	15.3	16.3	15.7	14.3	14.7	14.5	14.8	177.8	2.2%
2003	15.3	14.1	14.9	14.1	15.3	15.3	16.3	15.9	14.8	15.0	14.5	15.3	180.9	1.7%
2004	15.5	15.3	15.5	14.5	15.7	15.9	16.7	16.2	15.0	15.1	15.1	15.4	186.0	2.8%
2005	15.8	14.7	15.7	15.0	16.3	17.0	17.6	17.5	16.0	16.1	15.9	17.0	194.6	4.6%
2006	17.5	15.9	17.1	15.8	17.4	18.0	18.2	17.8	16.4	16.6	16.5	16.7	203.9	4.8%
2007	17.6	16.4	17.6	15.8	16.9	18.0	18.9	17.8	16.3	16.8	16.6	16.9	205.7	0.9%
2008	17.6	16.3	17.3	16.4	17.6	17.4	18.9	18.8	16.8	16.9	16.5	16.9	207.4	0.8%
2009	17.9	16.4	17.1	16.0	17.2	17.6	18.2	17.3	16.1	16.7	17.2	17.4	205.1	-1.1%
2010	17.8	16.5	17.3	16.0	17.2	17.7	18.5	18.0	16.5	16.4	16.1	16.4	204.4	-0.3%
2011	17.3	16.2	17.0	15.7	17.4	17.4	18.1	17.3	16.0	16.2	16.2	16.0	200.8	-1.7%
2012	17.0	16.2	16.3	15.4	17.0	17.0	17.5	17.0	15.3	15.7	15.6	16.0	196.0	-2.4%
2013	17.0	15.2	16.4	15.1	16.4	16.5	16.9	16.2	14.8	15.4	15.1	15.7	190.6	-2.8%
2014	16.7	15.1	15.9	14.9	15.9	15.9	17.0	16.5	14.8	15.1	15.1	15.5	188.3	-1.2%
2015	16.2	14.9	15.9	14.9	16.0	16.5	17.4	16.6	15.2	15.3	15.3	16.3	190.5	1.1%
2016	16.3	15.9	16.5	15.0	15.7	16.5	17.1	16.7	15.2	14.9	15.2	15.9	191.0	0.2%
2017	16.9	15.5	16.3	14.3	16.0	16.6	16.9	16.5	15.0	15.0	15.1	16.0	190.0	-0.5%
2018	17.0	15.1	15.8	14.9	16.0	16.7	17.0	16.5	14.9	14.9	14.8	15.8	189.5	-0.3%
2019	17.4	14.9	16.2	14.5	15.8	16.4	16.7	16.4	14.6	14.7	14.6	15.8	188.3	-0.6%
2020	16.6	15.2	15.1	14.1	15.5	16.2	17.0	16.1	14.1	14.3	14.5	15.1	183.9	-2.3%
2021	15.5	14.1	15.3	14.5	15.8	16.5	17.2	15.8	14.1	14.2	14.0	14.7	181.6	-1.3%
2022	16.0	14.1	15.6	14.3	16.0	16.8	17.5	16.4	14.8	14.5	13.6	14.1	183.6	1.1%
2023	15.2	14.2	15.6	14.1	16.2	16.3	16.6	15.7	13.7	13.8	13.9	15.0	180.2	-1.9%
2024	15.7	15.2	15.4	14.3	15.9	16.9	17.6	15.7	13.9	13.6	14.2	14.9	183.3	1.7%
2025	15.3	14.4	15.8	14.1	15.7	17.1	17.7	16.6	14.1	14.3				
	-2.7%	-5.3%	2.9%	-1.5%	-1.5%	1.6%	0.7%	5.7%	1.5%	4.9%			vs. pcp	
	-2.7%	-4.0%	-1.7%	-1.7%	-1.6%	-1.0%	-0.8%	0.0%	0.2%	0.6%			YTD vs. pcp	
	0.8%	0.0%	0.3%	0.2%	0.0%	0.1%	0.2%	0.6%	0.6%	0.9%			FYTD vs. pcp	

Source: Australian Energy Market Operator (AEMO), Morgan Stanley Research.

Exhibit 119: NSW nighttime load (MW) Jan-Oct 2020-2025



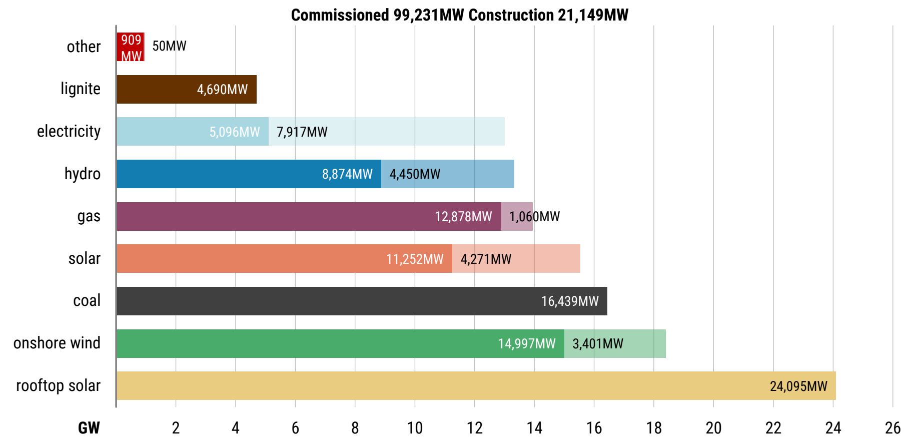
Source: AEMO, Morgan Stanley Research.

Supply. On the supply side, we are tracking ~21GW of new entrant plant under construction (Exhibit 120), with 5.2GW commissioned YTD, and we see current reform proposals for capacity auctions as benign.

The key uncertainty in the supply mix is the closure of coal plants (Exhibit 121), many of which are reaching end of operational lives, even if their reliability is still needed. Most exiting plants have negotiated closure arrangements with state governments, and we anticipate policy-maker underwriting will continue to ensure security of supply.

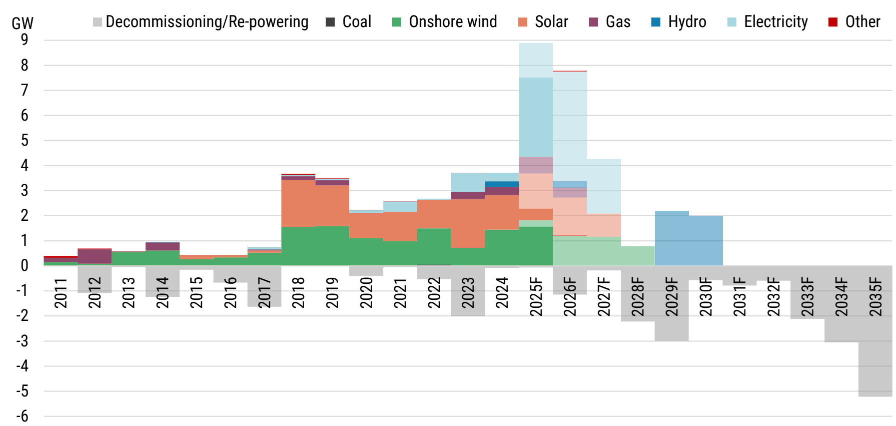
Many Australian utilities have significant dispatchable plant investment pipelines, with ~8GW of batteries and ~1GW of gas generation under construction. Australia's high domestic gas price (~A$13/GJ, or ~A$143/MWh at an 11GJ/MWh heat rate, implying a NSW sparkspread of -A$30/MWh), and lack of long-term gas supply agreements, means the gas generation may be reserved for long-duration storage applications (with low capacity utilisation).

Exhibit 120: NEM generation capacity



Source: Company and media reports (e.g., RenewEconomy, Inframation), AEMO, Morgan Stanley Research.

Exhibit 121: NEM new entrants (by fuel source) vs. retirements/repowering



Source: Company and media reports (e.g., RenewEconomy, Inframation), AEMO, Morgan Stanley Research estimates

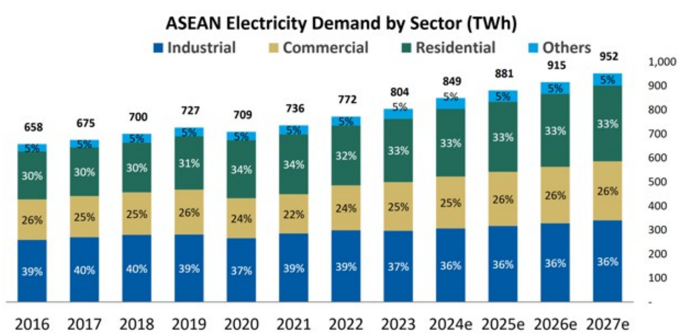
Southeast Asia

Mayank Maheshwari, Ryan M Heng

Southeast Asia is emerging as a key hub for China and US hyperscalers to deploy AI infrastructure to leverage excess power generation capacity in the region, as well as enjoying policy support from governments to roll out for digital adoption. Malaysia, Singapore and, increasingly, Thailand are attracting most the new hyperscaler investments in the region, with 10GW in potential future AI capacity leading to tighter power markets that will be serviced increasingly by natural gas-fired generation.

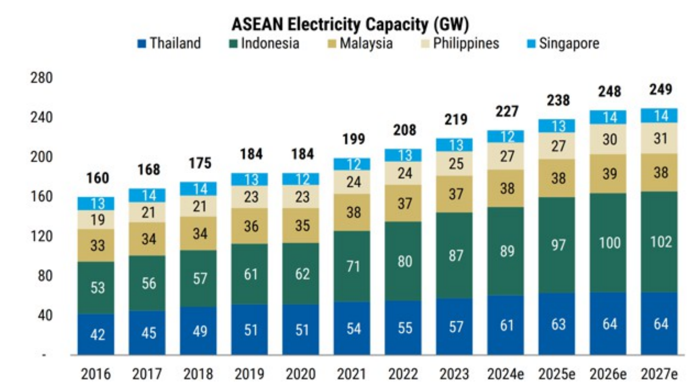
Short-term slow down, long-term growth intact: Power demand in Southeast Asia has slowed in 2025 to ~2% vs ~4.5% in 2024 given cooler weather and reduced industrial activity. We remain selective in power utilities in the region, preferring grid operators, such as **Tenaga** and **Manila Electric,** as well as capacity payment IPPs, such as **Gulf Development**. Longer term, we are constructive as structural tailwinds of data center build outs, especially in Malaysia, Thailand and Singapore, and reshoring of supply chains in Vietnam, Thailand and Malaysia drives the next leg of power demand growth. Tight power markets in Singapore, the Philippines and increasingly Malaysia are also driving the next leg of generation capacity additions, benefiting power producers such as **Keppel.**

Exhibit 122: We expect ASEAN electricity demand to continue its pre-Covid demand trajectory, keeping generation markets tight...



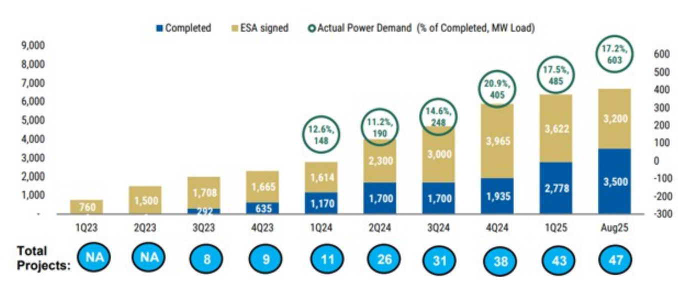
Source: IRENA, BP, PLN Indonesia, EPPO Thailand, ST Suruhanjaya Malaysia, DOE Philippines, EMA Singapore, Morgan Stanley Research estimates

Exhibit 123: ...while supply addition catches up closer to the end of the decade



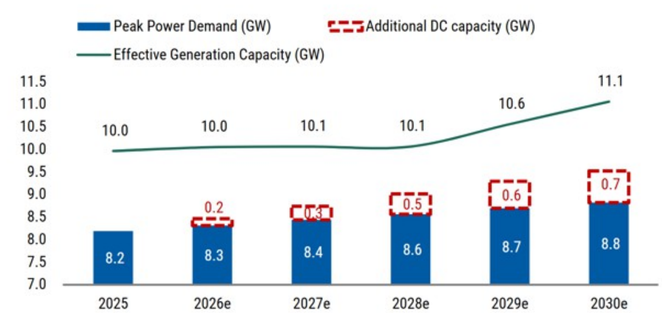
Source: IRENA, BP, PLN Indonesia, EPPO Thailand, ST Suruhanjaya Malaysia, DOE Philippines, EMA Singapore, Morgan Stanley Research estimates

Exhibit 124: Tenaga's data center pipeline continues to grow reaching 6.7GW (ie 30% of system peak demand) in Aug-25



Source: Company data, Morgan Stanley Research estimates

Exhibit 125: In Singapore the newly announced 700MW datacenters would keep singapore power markets tight



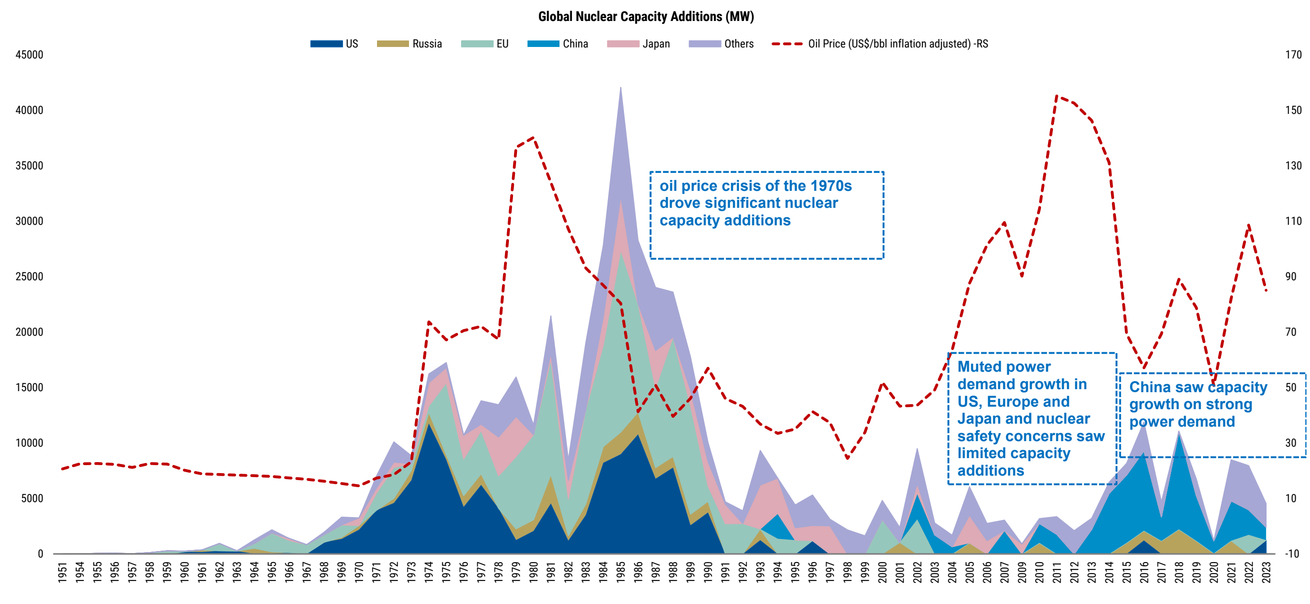
Source: EMA, Morgan Stanley Research estimates

Rise in Nuclear Adoption - Lessons from 1970s

The tight power markets are seeing nuclear technology usage become mainstream again after 50 years. Based on MS capacity projections, potential investment in the nuclear value chain through 2050 will be around US$2.2 trillion, up from the US$1.5 trillion we projected last year. China, the US, CEEMEA, and India will likely lead the rise in global nuclear capacity. With Asia emerging as the centre of nuclear capacity growth, the region presents a number of opportunities for investors. We highlight this surge in nuclear technology usage in context of learnings from the 1970s.

Oil price shocks in the late 1970s drove energy security concerns, which led to the rapid expansion of nuclear power during this period. It saw unprecedented growth in nuclear energy development, followed by decades of slower additions (Exhibit126). During the peak construction period of the 1970s, an average of 25-30 new nuclear units began construction each year. By 1980, there were 253 operational nuclear power plants worldwide, with an additional 230 units under construction. Global nuclear capacity experienced strong growth from less than 1 gigawatt (GW) in 1960 to >100GW by the late 1980s, and further expanding to >200GW by 1990. In the US specifically, approximately 95GW of nuclear capacity came online between 1970 and 1990, with 46 nuclear reactors commissioned in the 1980s alone.

Exhibit126: The Oil Crisis of the 1970s drove significant nuclear capacity expansion, however more recently, muted power demand growth and safety concerns saw limited capacity additions



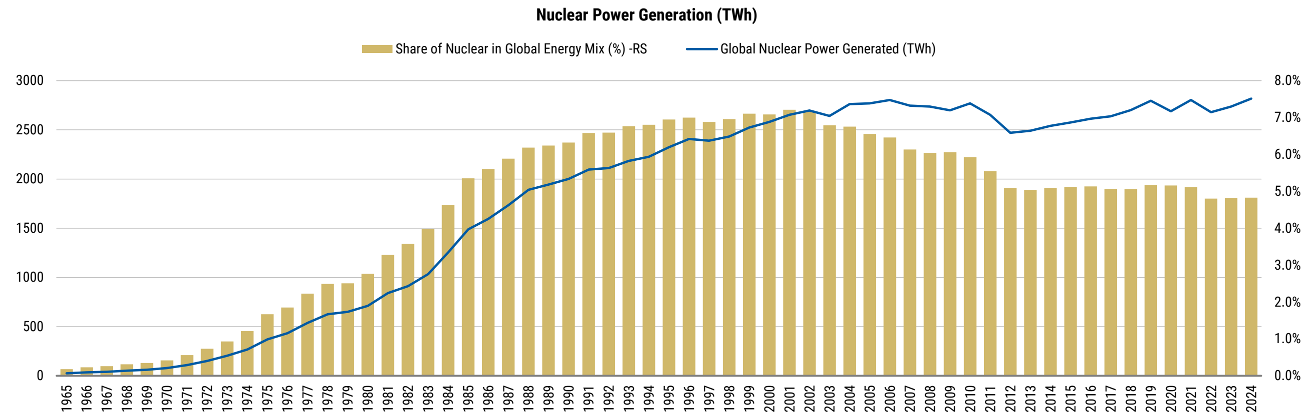
Source: Global Nuclear Power Tracker; Global Energy Monitor, Morgan Stanley Research

Today we are seeing similar drivers as in the 1970s, which are enabling the push for more nuclear power generation.

Drivers for Nuclear in 1970s	Drivers for Nuclear Today
Energy Security due to oil crisis	Energy Security due to a multipolar world

Growing electricity demand from electrification, industrial expansion and population & income growth	Growing electricity demand from AI, data centers, electrification and on shoring of supply chains
-	Grid reliability: Stable baseload to support renewables
-	Decarbonization goals

Exhibit 127: Nuclear power has declined in the global energy mix since the 1980s



Source: Statistical Review of World Energy, Morgan Stanley Research

While the factors which caused the considerable slow down in nuclear power plant additions since the 1980s are still relevant today, we are seeing increasing political and financial will for project completion.

Concerns for Nuclear since 1980s	Concerns for Nuclear Today
High construction costs and financing challenges for large-scale nuclear projects	High construction costs and financing challenges for large-scale nuclear projects
Increased regulatory requirements that extended construction timelines	Increased regulatory requirements that extended construction timelines
Safety concerns following incidents like Three Mile Island (1979), Chernobyl (1986), Fukushima (2011)	Improved safety features and technological improvements
Growing competition from cheaper natural gas and coal	Complements existing fleet of natural gas + renewables
Public opposition to nuclear power in many countries	Less public opposition to nuclear, although cross-border concerns exists
Slow down in power demand growth in US and Europe post 2008	Global power demand

Appendix: Equities to Play Powering AI

Exhibit 128: Most and Least Preferred stocks for Global Natural Gas Adoption

Company Name	Ticker	Market cap, current, USD (MM)	3M ADTV, USD (MM)	Rating	Share price, last close	Price Target (Local CCY)	% Upside from last close	Country	Sub-Sector	Key Investment Thesis	MS Analyst
Most Preferred Energy Names											
Gas Pipelines/Infrastructure											
Gujarat Gas	GGAS.NS	3,160.4	2.3	Overweight	403.40	495.00	22.7%	India	Gas Pipelines	Demand upside from cheaper gas	Mayank Maheshwari
GAIL	GAIL.NS	13,564.3	17.2	Overweight	183.41	236.00	28.7%	India	Gas Pipelines	Demand upside from cheaper gas	Mayank Maheshwari
Indraprastha Gas	IGAS.NS	3,391.3	12.0	Equal-Weight	212.66	192.00	-9.7%	India	Gas Pipelines	Demand upside from cheaper gas	Mayank Maheshwari
PTT Group	PTT.BK	26,651.2	53.7	Overweight	30.50	34.80	14.1%	Thailand	Gas Pipelines	Cheaper feedstock cost from low cost domestic gas production, demand upside from cheaper gas	Mayank Maheshwari
CR Gas	1193.HK	6,340.0	20.6	Equal-Weight	21.90	19.20	-12.3%	China	Gas Pipelines	LT contracts to cap gas price inflation, while medium term correction in prices to aid in boosting consumption	Albert Li
Mahanagar Gas	MGAS.NS	1,552.3	10.0	Overweight	1,253.30	1,749.00	39.6%	India	Gas Pipelines	Demand upside from cheaper gas	Mayank Maheshwari
APA Group	APA.AX	7,982.0	16.3	Equal-Weight	9.27	8.68	-6.4%	Australia	Gas Pipelines	Australia's largest gas pipeline company, benefits from increased gas usage over the medium term	Rob Koh
Tokyo Gas	9531.T	14,176.8	42.5	Equal-Weight	6,147.00	4,640.00	-24.5%	Japan	Gas Pipelines	Cheaper LNG is good for Japan Gas Utilities as these companies import LNG	Reiji Ogino
Osaka Gas	9532.T	13,094.1	29.1	Equal-Weight	5,207.00	4,130.00	-20.7%	Japan	Gas Pipelines	Cheaper LNG is good for Japan Gas Utilities as these companies import LNG	Reiji Ogino
Petronet LNG	PLNG.NS	4,743.7	7.8	Equal-Weight	273.60	346.00	26.5%	India	Gas Pipelines	Volume upside from cheaper imported gas	Mayank Maheshwari
Adnoc Logistics & Services	ADNOCLS.AD	8,663.1	6.8	Overweight	5.53 AED	6.60 AED	19.3%	India	Gas Pipelines	Volume upside from cheaper imported gas	Ricardo Rezende
Sempra	SRE.N	60,353.5	107.5	Overweight	92.00	99.00	7.6%	North America	Midstream	Volume upside	David Arcaro
Williams Companies Inc	WMB.N	72,991.8	125.0	Overweight	60.99	83.00	36.1%	North America	Midstream	Volume upside	Robert Kad
Energy Transfer	ET.N	62,870.2	38.0	Overweight	17.01	21.00	23.5%	North America	Midstream	Volume upside	Robert Kad
TC Energy Corp	TRP.TO	51,563.6	315.3	Overweight	77.45	87.00	12.3%	North America	Midstream	Volume upside	Robert Kad
Power											
Gulf Energy	GULF.BK	19,469.7	30.7	Overweight	41.50	69.00	66.3%	Thailand	Power Producers	Integrated gas infrastructure with demand upside	Mayank Maheshwari
Sembcorp Industries	SCIL.SI	8,906.1	23.3	Equal-Weight	6.48	7.00	8.0%	Singapore	Power Producers	Benefits from cheaper gas cost in gas trading & power generation business	Mayank Maheshwari
Keppel Ltd	KPLM.SI	14,257.2	27.2	Overweight	10.09	11.54	14.4%	Singapore	Power Producers	Benefits from cheaper gas cost in gas trading & power generation business	Mayank Maheshwari
Torrent Power	TOPO.NS	8,328.4	9.5	Equal-Weight	1,301.00	1,444.00	11.0%	India	Power Producers	Benefits from merchant gains on gas based power capacities	Girish Achhipalia
Tohoku Electric Power	9506.T	3,493.9	17.5	Overweight	1,090.50	1,520.00	39.4%	NA	Power Producers	Benefits from cheaper gas cost	Reiji Ogino
AGL Energy	AGL.AX	4,091.2	23.4	Equal-Weight	9.26	9.66	4.3%	Australia	Power Producers	Integrated utility whichbuys gas in wholesale markets supplying residential and commercial customers	Rob Koh
Tenaga Nasional	TENA.KL	18,885.5	14.3	Overweight	13.28	16.30	22.7%	Malaysia	Power Producers	Benefits from cheaper gas cost in gas trading & power generation business	Mayank Maheshwari
Manila Electric	MER.PS	10,912.3	2.5	Overweight	594.00	600.00	1.0%	Philippines	Power Producers	High reliance on gas, lower gas price along with rising nuclear mix should ease company's overall cost burden	Mayank Maheshwari
Equipment manufacturers											
GE Vernova	GEV.N	156,117.8	318.0	Overweight	578.31	710.00	22.8%	Industrials	Turbine Manufacturers	Strong order backlog for gas turbines	David Arcaro
Siemens Energy	ENR1n.DE	107,044.8	247.6	Overweight	110.50	125.00	13.1%	Industrials	Turbine Manufacturers	Strong order backlog for gas turbines	Max Yates
Chemicals											
Reliance Industries	RELI.NS	231,279.2	170.3	Overweight	1,518.90	1,701.00	12.0%	India	Chemicals	Higher gas production, cheaper feedstock and tight refining markets	Mayank Maheshwari
Gas Producers											
Oil & Natural Gas Corp	ONGC.NS	36,983.7	40.2	Overweight	247.60	299.00	20.8%	India	Gas Producer	Higher gas production and rising dividends	Mayank Maheshwari
Oil India	OILI.NS	9,083.4	18.1	Overweight	436.85	467.00	6.9%	India	Gas Producer	Higher gas production and tight refining markets	Mayank Maheshwari
Petrochina	0857.HK	24,624.5	103.1	Overweight	8.85 HKD	10.25 HKD	15.8%	China	Gas Producer	Domestic gas pricing reforms	Jack Lu
EQT Corp	EQT.N	37,968.2	101.5	Overweight	59.90	69.00	15.2%	North America	Gas Producer	LNG Export Demand	Devin McDermott
Antero Resources Corp	AR.N	12,936.6	51.3	Overweight	34.36	44.00	28.1%	North America	Gas Producer	LNG Export Demand	Devin McDermott
Expand Energy Corp	EXE.O	27,715.1	462.2	Overweight	117.28	136.00	16.0%	North America	Gas Producer	LNG Export Demand	Devin McDermott
YPF SA	YPF.N	14,271.4	14.4	Equal-Weight	38.67	37.00	-4.3%	South America	Gas Producer	Higher Demand drives production growth	Bruno Montanari
ADNOC Gas Plc	ADNOCGAS.AD	71,470.5	23.9	Equal-Weight	3.39 AED	3.90 AED	15.0%	Middle East	Gas Producer	Increased gas production in the UAE	Ricardo Rezende
Shell PLC	SHEL.L	211,651.0	311.4	Overweight	2,858.00 GBp	3,007.00 GBp	5.2%	Europe	Integrated Energy	Strong balance sheet, disciplined capex, defensive portfolio	Martijn Rats
Petrobras	PBR.N	47,258.2	62.4	Overweight	13.18	17.00	29.0%	Latin America	Integrated Energy	Strong FCF yield can support resilient base dividends and provide upside to additional extraordinary distributions	Bruno Montanari
LNG Export											
Qatar Gas Transport Nakilat	QGTS.QA	6,989.5	5.0	Equal-Weight	4.64	5.30	14.3%	MENA	LNG transportation	LNG Export Demand	Ricardo Rezende
Cheniere Energy	LNG.N	45,963.4	101.2	Overweight	215.19	258.00	19.9%	North America	LNG Terminal	LNG Export Demand	Devin McDermott
Less Preferred Energy Names											
Gas Producers											
PTT Exploration & Production	PTTEP.BK	12,810.3	36.8	Underweight	106.00	76.00	-28.3%	Thailand	Gas Producer	Lower gas price realisation & well supplied oil markets with skew to Thailand gas markets	Mayank Maheshwari
Beach Energy	BPT.AX	1,923.6	5.8	Underweight	1.29	1.10	-14.4%	Australia	Gas Producer	Lower gas price realisation with a skew to Australian domestic gas markets (2024 production 18-20MMboe)	Rob Koh
Santos Energy	STO.AX	14,661.3	51.5	Equal-Weight	6.67 AUD	6.76 AUD	1.3%	Australia	Gas Producer	Lower gas price realisation with projects in Australia, Papua New Guinea, and Alaska (2024 production 84-90MMboe, ~5% exposure to spot gas hub prices)	Rob Koh
Woodside Energy	WDS.AX	31,046.9	85.1	Equal-Weight	26.47 AUD	27.00 AUD	2.0%	Australia	Gas Producer	Lower gas price realisation with projects focused in Australia and the Gulf of Mexico (2024 production 185-195MMboe, ~10% exposure to spot gas hub prices)	Rob Koh
Coal											
Alamtri Resources Indonesia	ADRO.JK	3,780.9	12.6	Underweight	1,910.00 IDR	1,466.00 IDR	-23.2%	Indonesia	Coal	Quicker than expected coal to gas switching puts pressure on coal demand and prices	Mayank Maheshwari
Shaanxi Coal	601225.SS	26,945.5	100.2	Equal-Weight	24.03	19.70	-18.0%	China	Coal	Correction in energy prices, particularly LNG will put pressure on coal prices	Hannah Yang
Yankuang Energy	600188.SS	10,165.5	41.3	Underweight	14.85	10.30	-30.6%	China	Coal	Correction in energy prices, particularly LNG will put pressure on coal prices	Hannah Yang
United Tractors	UNTR.JK	5,050.5	6.7	Equal-weight	28,025.00	24,300.00	-13.3%	Indonesia	Coal	Quicker than expected coal to gas switching puts pressure on coal demand and prices	Mayank Maheshwari
Coal India	COAL.NS	28,179.7	31.8	Equal-Weight	386.95	410.00	6.0%	India	Cement	Lower gas prices are negative for thermal coal prices, and can impact both offtake and e-auction prices for Coal India.	Rahul Gupta
Chemicals											
Petronas Chemicals	PCGB.KL	6,317.3	4.1	Overweight	3.41	4.30	26.1%	Malaysia	Chemicals	Loses competitiveness on Global Cost curve	Mayank Maheshwari

Source: Morgan Stanley Research, Priced as at November 14, 2025

Exhibit 129: Most and Least Preferred stocks for Asia: Powering AI in Asia

Company Name	Ticker	Market cap, current, USD (MM)	3M ADTV, USD (MM)	Rating	Share price, last close	Price Target (Local CCY)	% Upside from last close	Country	Sub-Sector	Key Exposure Thesis	MS Analyst
Exposed to Powering AI Thematic											
Grid Operators											
Tenaga Nasional	TENA.KL	18,886	14	Overweight	13.42	16.30	21.5%	Malaysia	Grid Operator	Single grid operator benefits from doubling power demand	Mayank Maheshwari
APA Group	APA.AX	7,982	16	Equal-Weight	9.37	8.68	-7.4%	Australia	Grid Operator	Bidding for new transmission line projects	Rob Koh
Power Generators											
Hokkaido Electric Power	9509.T	1,471	51	Overweight	1,065.00	1,450.00	36.2%	Japan	Integrated Power Utility	The company's service area is cooler hence making Hokkaido an advantageous location for AI datacenters	Reiji Ogino
Sembcorp Industries	SCIL.SI	8,906	23	Equal-Weight	6.44	7.00	8.7%	Singapore	Hybrid Power	Tight electricity markets as Singapore expands DC capacity	Mayank Maheshwari
Keppel	KPLM.SI	14,257	27	Overweight	10.04	11.54	14.9%	Singapore	Hybrid Power	Tight electricity markets as Singapore expands DC capacity	Mayank Maheshwari
Gulf Development	GULF.BK	19,470	31	Overweight	41.50	69.00	66.3%	Thailand	Hybrid Power	Integrated DC + generation portfolio	Mayank Maheshwari
AGL Energy	AGL.AX	4,091	23	Equal-Weight	9.21	9.66	4.9%	Australia	Integrated utility	Leverage to power prices and renewable development	Rob Koh
CGN Power	1816.HK	4,424	26	Overweight	3.03 HKD	2.81 HKD	-7.3%	China	Nuclear	Increased power demand from datacenters	Albert Li
China Resources Power	0836.HK	12,949	43	Overweight	19.00	23.70	24.7%	China	Hybrid Power	Increased Clean power demand from datacenters	Albert Li
Gas Pipelines											
GAIL	GAIL.NS	13,564	17	Overweight	183.41	236.00	28.7%	India	Gas Pipelines	Integrated Gas Player	Mayank Maheshwari
Tokyo Gas	9531.T	14,177	43	Equal-Weight	6,077.00	4,640.00	-23.6%	Japan	Gas Pipelines	Integrated Gas Player	Reiji Ogino
Osaka Gas	9532.T	13,094	29	Equal-Weight	5,189.00	4,130.00	-20.4%	Japan	Gas Pipelines	Integrated Gas Player	Reiji Ogino
Data Center Operators											
NEXTDC	NXT.AX	5,452	21	Overweight	13.82	20.50	48.3%	Australia	Data Centers	Early DCs have >20% IRR, but higher land/development costs point to 10-12% ahead.	Andrew McLeod
Singapore Telecom	STEL.SI	49,916	93	Overweight	4.86	5.00	2.9%	Singapore	Data Centers	STEL's connectivity, power partnerships, and access to Nvidia's GPUs are key advantages to epand its AI DC footprint	Da Wei Lee
Goodman Group	GMG.AX	43,106	99	Overweight	29.57	41.50	40.3%	Australia	Data Centers	Global DC 3.9GW DC pipeline of secured power, plus ~1-2GW in procurement. Est A$40bn+ end product at 50%+ margins	Simon Chan
Macquarie Technology	MAQ.AX	1,023	4	Overweight	61.22	85.00	38.8%	Australia	Data Centers	High quality portfolio + an attractive pipeline of future DC re-investment opportunities	Andrew McLeod
GDS Holdings	GDS.O	5,540	86	Overweight	29.66 USD	54.00 USD	82.1%	China	Data Centers	China data center demand growth	Yang Liu
Keppel DC REIT	KEPE.SI	3,806	14	Equal-Weight	2.37	2.30	-3.0%	Singapore	Data Centers	Pure-play DC REIT	Derek Chang
SUNeVision	1686.HK	1,842	21	Overweight	5.40	9.00	66.7%	Hong Kong	Data Centers	Leading position in Hong Kong IDC market	Tom Tang
VNET Group	VNET.O	1,610	76	Overweight	8.80 USD	14.00 USD	59.1%	China	Data Centers	China data center demand growth	Tom Tang
Equipment Manufacturers											
Delta Electronics	2308.TW	32,291	103	Overweight	922.00	1,288.00	39.7%	Taiwan	Power Electronics	Key vendor of power electronics (~62% of total revenue) that improves electrical efficiency of data centers	Sharon Shih
Polycab India	POLC.NS	13,073	20	Overweight	7,632.00	8,672.00	13.6%	India	Wires and cables	Targets 10% export exposure by F26	Girish Achhipalia
NARI Tech	600406.SS	27,199	221	Overweight	23.80	26.51	11.4%	China	Power Grid Equipment	Power demand growth requires grid hardening capex	Eva Hou
XJ Electric	000400.SZ	4,132	152	Overweight	27.31	27.04	-1.0%	China	Power Grid Equipment	Power demand growth requires grid hardening capex	Eva Hou
Pinggao Electric	600312.SS	3,503	83	Overweight	17.95	19.88	10.8%	China	Power Grid Equipment	Power demand growth requires grid hardening capex	Eva Hou
HD Hyundai Electric	267260.KS	20,926	82	Overweight	824,000.00	900,000.00	9.2%	S. Korea	Power Grid Equipment	Power demand growth requires grid hardening capex	Ryan Kim
LS Electric	010120.KS	9,067	55	Equal-Weight	453,000.00	330,000.00	-27.2%	S. Korea	Power Grid Equipment	Power demand growth requires grid hardening capex	Ryan Kim
Integrated Energy											
PTT Group	PTT.BK	26,651	54	Overweight	30.50	34.80	14.1%	Thailand	Integrated Energy	Integrated Energy	Mayank Maheshwari
Reliance Industries	RELI.NS	231,279	170	Overweight	1,518.90	1,701.00	12.0%	India	Integrated Energy	Integrated Energy + expansion in new energy and AI DCs	Mayank Maheshwari
PetroChina	0857.HK	24,625	103	Overweight	8.79 HKD	10.25 HKD	16.6%	China	Integrated Energy	Integrated Gas Player	Jack Lu
Liquid Cooling											
AVC	3017.TW	7,781	127	Overweight	1,420.00	1,800.00	26.8%	Taiwan	Liquid Cooling	Liquid Cooling Exposure	Sharon Shih
Auras	3324.TWO	1,736	61	Equal-Weight	990.00	1,066.00	7.7%	Taiwan	Liquid Cooling	Liquid Cooling Exposure	Sharon Shih
Envicool	002837.SZ	3,257	123	Overweight	70.17	74.00	5.5%	China	Liquid Cooling	Liquid Cooling Exposure	Chelsea Wang
Inspur Electronic Information	000977.SZ	9,946	354	Equal-Weight	59.25	56.50	-4.6%	China	Liquid Cooling	Liquid Cooling Exposure	Howard Kao

Source: Morgan Stanley Research, Priced as at November 14, 2025

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The following analysts hereby certify that their views about the companies and their securities discussed in this report are accurately expressed and that they have not received and will not receive direct or indirect compensation in exchange for expressing specific recommendations or views in this report: Girish Achhipalia; Fernando P Amaral; David Arcaro, CFA; Amit Bhinde; Stephen C Byrd; Tim Chan, CFA; Samantha R Edie; Ehsernta Fu; Eva Hou; Rob Koh; Jack Lu; Mayank Maheshwari; Devin McDermott; Reiji Ogino; Robert Pulleyn; Martijn Rats, CFA; Ricardo Rezende, CFA; Arthur Sitbon, CFA; Max R Yates.

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(as of October 31, 2025)

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	Coverage Universe		Investment Banking Clients (IBC)			Other Material Investment Services Clients (MISC)	
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category	Count	% of Total Other MISC
Overweight/Buy	1501	41%	384	46%	26%	703	41%
Equal-weight/Hold	1609	44%	370	44%	23%	788	46%
Not-Rated/Hold	4	0%	1	0%	25%	1	0%
Underweight/Sell	568	15%	80	10%	14%	223	13%
Total	3,682		835			1715	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

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Overweight (O or Over) - The stock's total return is expected to exceed the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

Equal-weight (E or Equal) - The stock's total return is expected to be in line with the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

Not-Rated (NR) - Currently the analyst does not have adequate conviction about the stock's total return relative to the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U or Under) - The stock's total return is expected to be below the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

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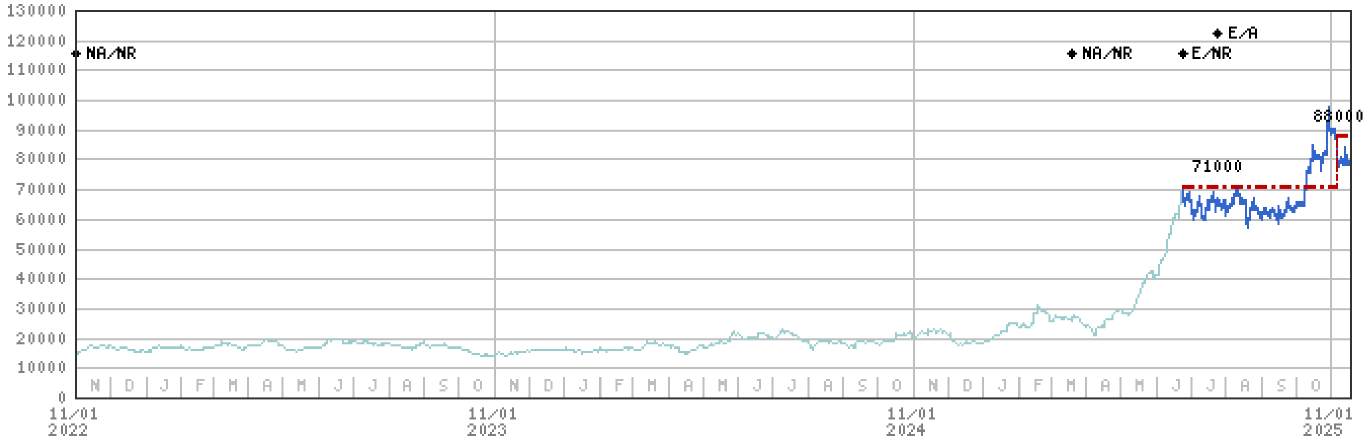
Stock Price, Price Target and Rating History (See Rating Definitions)

Doosan Enerbility (034020.KS) - As of 11/17/25 GMT in KRW
Industry : S. Korea Industrials



Stock Rating History: 11/1/20 : NA/NR; 12/11/20 : NA/NR; 3/20/25 : NA/NR; 6/24/25 : E/NR; 7/25/25 : E/A

Price Target History: 12/11/20 : NA; 6/24/25 : 71000; 11/6/25 : 88000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) —
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

HD Hyundai Electric Co Ltd (267260.KS) - As of 11/17/25 GMT in KRW
Industry : S. Korea Technology

Stock Rating History: 11/1/20 : NA/A; 7/19/21 : NA/I; 8/12/21 : NA/C; 10/4/22 : NA/A; 7/21/24 : NA/I; 9/15/24 : NA/C; 3/25/25 : O/C; 6/13/25 : O/I; 9/21/25 : O/A

Price Target History: 3/25/25 : 460000; 6/24/25 : 600000; 10/21/25 : 800000; 10/23/25 : 900000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) —
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

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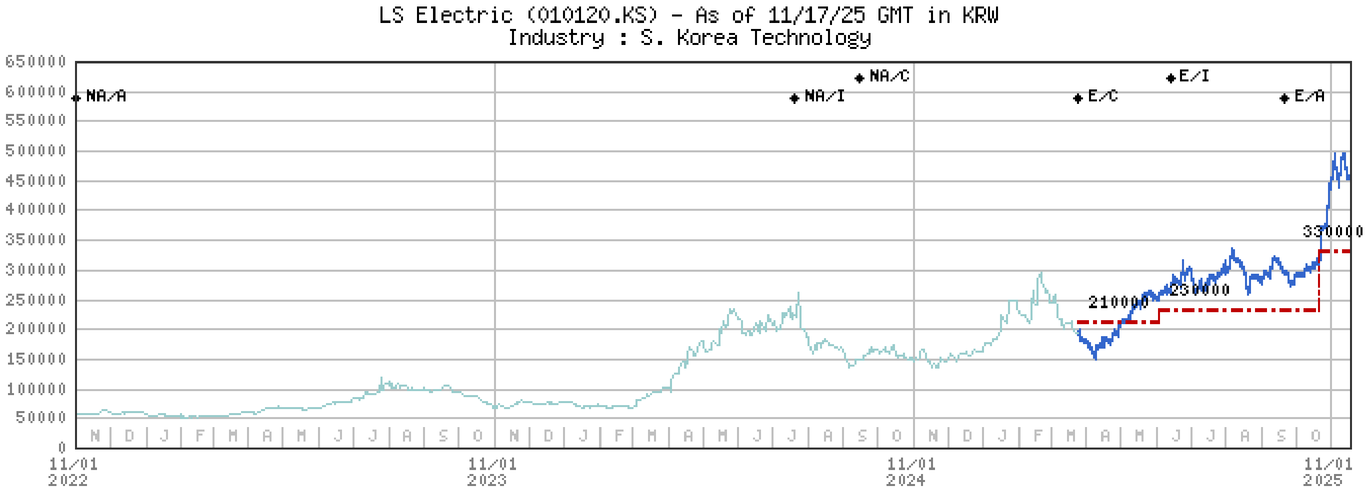

Stock Rating History: 11/1/20 : NA/A; 7/19/21 : NA/I; 8/12/21 : NA/C; 10/4/22 : NA/A; 7/21/24 : NA/I; 9/15/24 : NA/C; 3/25/25 : E/C; 6/13/25 : E/I; 9/21/25 : E/A

Price Target History: 3/25/25 : 210000; 6/3/25 : 230000; 10/21/25 : 330000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) Stock Price (Covered by Current Analyst)
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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INDUSTRY COVERAGE: ASEAN Utilities and Infrastructure

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Mayank Maheshwari		
Aboitiz Power Corporation (AP.PS)	U (06/30/2021)	PP41.50
Airports of Thailand (AOT.BK)	O (08/25/2021)	Bt41.25
Global Power Synergy PCL (GPSC.BK)	U (09/12/2025)	Bt36.25
Gulf Development PCL (GULF.BK)	O (03/26/2025)	Bt42.25
Manila Electric Company (MER.PS)	O (06/20/2022)	PP594.00
Perusahaan Gas Negara (PGAS.JK)	U (05/17/2023)	Rp1,750
SembCorp Industries Ltd (SCIL.SI)	E (08/11/2025)	S$6.48
Tenaga Nasional (TENA.KL)	O (09/12/2023)	RM13.28
Vivek Rajamani		
International Container Terminal Service (ICT.PS)	O (03/04/2024)	PP560.00

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

INDUSTRY COVERAGE: Australia Utilities & Infrastructure

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Rob Koh		
AGL Energy Ltd (AGL.AX)	E (03/05/2025)	A$9.26
APA Group (APA.AX)	E (10/25/2023)	A$9.27
Atlas Arteria (ALX.AX)	E (07/20/2022)	A$4.98
Auckland International Airport Ltd (AIA.NZ)	E (02/23/2023)	NZ$7.90

Aurizon Holdings (AZJ.AX)	U (03/17/2025)	A$3.44
Cleanaway Waste Management Limited (CWY.AX)	O (01/14/2022)	A$2.52
Origin Energy Ltd. (ORG.AX)	U (08/15/2024)	A$12.10
Transurban Group (TCL.AX)	E (10/18/2021)	A$14.92
Samantha R Edie		
Qube Holdings (QUB.AX)	O (10/13/2025)	A$4.31

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* Historical prices are not split adjusted.

INDUSTRY COVERAGE: Brazil Electric Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (//)
Fernando P Amaral		
Alupar Investimento SA (ALUP11.SA)	E (06/26/2023)	R$34.26
Auren Energia SA (AURE3.SA)	E (09/07/2022)	R$11.17
AXIA Energia (AXIA3.SA)	O (09/18/2023)	
AXIA Energia (AXIA6.SA)	O (09/18/2023)	
Companhia Energetica de Minas Gerais (CMIG4.SA)	U (01/20/2025)	R$11.24
Companhia Paranaense de Energia (CPLE5.SA)	O (09/18/2023)	R$14.60
CPFL ENERGIA (CPFE3.SA)	E (04/10/2025)	R$46.10
Energisa SA (ENGI11.SA)	O (03/08/2021)	R$54.28
Engie Brasil (EGIE3.SA)	U (01/20/2025)	R$43.17
Equatorial Energia SA (EQTL3.SA)	O (05/07/2019)	R$39.46
ISA ENERGIA BRASIL SA (ISAE4.SA)	U (03/12/2024)	R$27.42
Light (LIGT3.SA)	E (08/03/2020)	R$5.68
Transmissora Alianca Energia Eletrica SA (TAEE11.SA)	U (11/30/2020)	R$45.00

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INDUSTRY COVERAGE: China Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Albert Li		
CGN Power Co., Ltd (1816.HK)	O (08/10/2023)	HK$3.01
CGN Power Co., Ltd (003816.SZ)	U (03/29/2021)	Rmb3.94
China Gas Holdings (0384.HK)	E (11/09/2023)	HK$8.69
China Resources Gas Group Ltd (1193.HK)	E (02/19/2025)	HK$21.90
China Resources Power (0836.HK)	O (04/18/2024)	HK$18.99
Huaneng Power International Inc. (0902.HK)	E (06/30/2022)	HK$6.28
Huaneng Power International Inc. (600011.SS)	U (04/07/2021)	Rmb7.87
Kunlun Energy (0135.HK)	O (02/19/2025)	HK$7.29
Eva Hou		
China Longyuan Power Group (0916.HK)	O (05/27/2024)	HK$7.16
China Longyuan Power Group (001289.SZ)	E (08/06/2024)	Rmb17.21
China Yangtze Power Co. (600900.SS)	O (11/14/2023)	Rmb28.16
Goldwind (002202.SZ)	E (08/17/2022)	Rmb14.92
Goldwind (2208.HK)	E (08/17/2022)	HK$12.56
Guangdong Investment (0270.HK)	O (08/18/2020)	HK$7.75
Hangzhou First Applied Material Co. Ltd (603806.SS)	O (01/18/2023)	Rmb15.51
Henan Pinggao Electric (600312.SS)	O (01/18/2024)	Rmb17.98
Hoyuan Green Energy Co. Ltd (603185.SS)	E (11/02/2024)	Rmb35.50
JA Solar Technology Co Ltd (002459.SZ)	E (09/02/2025)	Rmb14.20
Jiangsu Zhongtian Technology Co. Ltd. (600522.SS)	O (10/12/2020)	Rmb16.35
LONGi Green Energy Technology Co Ltd (601012.SS)	U (09/02/2025)	Rmb21.69
Ming Yang Smart Energy (601615.SS)	U (08/06/2024)	Rmb14.25

NARI Technology (600406.SS)	O (11/01/2015)	Rmb23.69
Ningbo Orient Wires & Cables Co Ltd (603606.SS)	O (08/17/2022)	Rmb59.98
Riyue Heavy Industry Co., Ltd. (603218.SS)	O (02/11/2025)	Rmb13.78
Shanghai Electric (2727.HK)	U (03/26/2021)	HK$4.25
Shanghai Electric (601727.SS)	U (03/26/2021)	Rmb8.85
Sieyuan Electric Co.Ltd. (002028.SZ)	O (07/01/2025)	Rmb144.88
Sinoma Science & Technology Co. Ltd. (002080.SZ)	O (09/23/2025)	Rmb32.70
Tongwei Co. Ltd. (600438.SS)	E (09/02/2025)	Rmb25.22
XJ Electric (000400.SZ)	O (01/18/2024)	Rmb27.53
Zhejiang Chint Electrics (601877.SS)	E (12/06/2022)	Rmb30.70
Hannah Yang, CFA		
Xinyi Solar Holdings Ltd (0968.HK)	O (07/30/2020)	HK$3.67

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* Historical prices are not split adjusted.

INDUSTRY COVERAGE: Diversified Utilities / IPPs

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/14/2025)
David Arcaro, CFA		
AES Corp. (AES.N)	O (03/23/2020)	US$13.82
American Electric Power Co (AEP.O)	O (03/10/2020)	US$121.30
Constellation Energy Corporation (CEG.O)	++	US$338.52
MGE Energy, Inc. (MGEE.O)	U (11/17/2021)	US$83.67
NextEra Energy Inc (NEE.N)	O (09/06/2022)	US$83.88
NRG Energy Inc (NRG.N)	E (12/09/2022)	US$165.19
Public Service Enterprise Group Inc (PEG.N)	O (07/02/2020)	US$82.84
Talen Energy Corp (TLN.O)	O (03/12/2025)	US$360.92
Vistra Corp (VST.N)	O (03/25/2019)	US$174.69

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INDUSTRY COVERAGE: EEMEA - Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Ricardo Rezende, CFA		
ACWA Power Company SJSC (2082.SE)	U (04/17/2024)	SAR 213.70
Dubai Electricity & Water Authority PJSC (DEWAA.DU)	E (06/06/2025)	AED 2.76
Emirates Central Cooling Systems Corp (EMPOWER.DU)	O (06/06/2025)	AED 1.57

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INDUSTRY COVERAGE: Energy & Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Reiji Ogino		
Chubu Electric Power (9502.T)	E (03/01/2024)	¥2,330
Chugoku Electric Power (9504.T)	O (03/01/2024)	¥981
Cosmo Energy Holdings (5021.T)	O (12/03/2024)	¥3,947
Electric Power Development (9513.T)	U (03/01/2024)	¥2,961
ENEOS Holdings (5020.T)	E (03/01/2024)	¥1,054
Hokkaido Electric Power (9509.T)	O (12/17/2024)	¥1,108
Hokuriku Electric Power (9505.T)	E (03/01/2024)	¥931
Idemitsu Kosan (5019.T)	E (03/01/2024)	¥1,139
INPEX (1605.T)	O (07/12/2021)	¥3,177
Iwatani (8088.T)	E (06/06/2025)	¥1,686

Japan Petroleum Exploration (1662.T)	E (12/04/2017)	¥1,391
Kansai Electric Power (9503.T)	E (12/11/2024)	¥2,560
Kyushu Electric Power (9508.T)	E (03/01/2024)	¥1,623
Osaka Gas (9532.T)	E (11/18/2024)	¥5,207
Shikoku Electric Power (9507.T)	E (03/01/2024)	¥1,453
Toho Gas (9533.T)	U (03/01/2024)	¥4,872
Tohoku Electric Power (9506.T)	O (03/01/2024)	¥1,091
TOKYO GAS (9531.T)	E (03/01/2024)	¥6,147

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* Historical prices are not split adjusted.

INDUSTRY COVERAGE: Hong Kong Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Albert Li		
Hong Kong & China Gas (0003.HK)	E (05/30/2022)	HK$7.41
Eva Hou		
CK Infrastructure Holdings Ltd (1038.HK)	E (10/14/2019)	HK$54.35
CLP Holdings (0002.HK)	E (02/26/2025)	HK$69.00
Power Assets Holdings Ltd (0006.HK)	E (10/14/2019)	HK$51.60

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INDUSTRY COVERAGE: India Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Girish Achhipalia		
Adani Power Ltd (ADAN.NS)	O (09/18/2025)	Rs153.28
JSW Energy Limited (JSWE.NS)	O (02/20/2025)	Rs527.65
NTPC (NTPC.NS)	O (11/21/2019)	Rs330.20
Power Grid Corporation of India (PGRD.NS)	E (09/26/2024)	Rs273.55
ReNew Energy Global PLC (RNW.O)	E (09/26/2024)	US$7.46
Tata Power Co (TTPW.NS)	E (08/04/2025)	Rs392.75
Torrent Power Ltd (TOPO.NS)	E (02/11/2025)	Rs1,310.00

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INDUSTRY COVERAGE: Latin America Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/14/2025)
Fernando P Amaral		
Central Puerto SA (CEPU.N)	E (08/12/2019)	US$14.93
CFE Capital S. de R.L. de C.V. (FCFE18.MX)	E (03/12/2023)	M$22.20
Copasa (CSMG3.SA)	E (04/13/2023)	R$39.35
Empresa Distribuidora y Comercializadora (EDN.N)	E (08/19/2025)	US$32.33
Enel Americas SA (ENELAM.SN)		Ch$89.52
Enel Chile (ENELCHILE.SN)	O (10/13/2021)	Ch$71.35
Sabesp (SBSP3.SA)	O (03/17/2022)	R$143.10
Sanepar (SAPR11.SA)	E (03/17/2022)	R$36.01

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INDUSTRY COVERAGE: Regulated Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/14/2025)
David Arcaro, CFA		
Algonquin Power & Utilities Corp (AQN.N)		US$6.07
Ameren Corp (AEE.N)	E (04/14/2020)	US$105.02
Atmos Energy Corp. (ATO.N)	O (12/15/2020)	US$175.12
CenterPoint Energy Inc (CNP.N)	E (07/17/2024)	US$39.74
CMS Energy Corp (CMS.N)	E (07/31/2017)	US$73.94
Consolidated Edison Inc (ED.N)	U (07/02/2020)	US$101.66
Dominion Energy Inc (D.N)	E (12/02/2024)	US$60.56
DTE Energy Co. (DTE.N)	O (01/06/2022)	US$137.10
Duke Energy Corp (DUK.N)	E (08/25/2014)	US$122.71
Edison International (EIX.N)	U (09/06/2022)	US$58.71
Entergy Corp (ETR.N)	E (11/04/2024)	US$95.05
Eversource Energy (ES.N)		US$73.30
Exelon Corp (EXC.O)	E (12/18/2023)	US$45.94
FirstEnergy Corp (FE.N)	O (03/23/2020)	US$45.94
IDACORP Inc (IDA.N)	E (03/13/2024)	US$128.29
ONE Gas Inc (OGS.N)	E (01/06/2022)	US$81.07
PG&E Corp (PCG.N)	E (09/18/2025)	US$16.49
Pinnacle West Capital Corp (PNW.N)	E (03/23/2020)	US$88.39
PPL Corp (PPL.N)	O (12/15/2022)	US$36.76
Sempra (SRE.N)	O (12/13/2024)	US$92.00
Southern Company (SO.N)	E (08/10/2023)	US$90.69
Spire Inc (SR.N)	E (09/01/2020)	US$87.00
Xcel Energy Inc (XEL.O)	E (10/19/2021)	US$80.58

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INDUSTRY COVERAGE: Utilities

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/14/2025)
Arthur Sitbon, CFA		
CEZ (CEZP.PR)	U (01/06/2023)	CZK 1,288.00
Corporacion Acciona Energia Renovables (ANE.MC)	E (04/16/2025)	€22.66
EDP Energias de Portugal SA (EDP.LS)	E (02/10/2025)	€3.83
EDP Renovaveis (EDPR.LS)	E (10/24/2025)	€11.58
Enagas SA (ENAG.MC)	U (09/15/2020)	€14.09
ENGIE (ENGIE.PA)	O (10/19/2020)	€21.80
Hidroelectrica SA (ROH2O.BX)	U (01/22/2024)	RON120.60
NEL ASA (NEL.OL)	U (10/29/2024)	NKr 2.40
Redeia (REDE.MC)	O (09/02/2025)	€15.08
Solaria Energia y Medio Ambiente SA (SLRS.MC)	U (11/02/2025)	€15.52
Veolia (VIE.PA)	E (08/26/2025)	€29.07
Voltalia SA (VLTSA.PA)	E (07/18/2022)	€7.30
Harrison Williams, CFA		
Centrica (CNA.L)	O (09/17/2025)	168p
Drax Group Plc (DRX.L)	E (07/29/2024)	745p
Elia (ELI.BR)	O (04/09/2025)	€103.80
Fortum Oyj (FORTUM.HE)	U (11/14/2025)	€19.05
Verbund AG (VERB.VI)	U (08/09/2023)	€64.35
Robert Pulleyn		
E.ON (EONGn.DE)	E (07/21/2025)	€15.25
Endesa SA (ELE.MC)	U (12/11/2023)	€32.14
ENEL (ENEI.MI)	E (08/01/2025)	€8.98

Iberdrola SA (IBE.MC)	E (03/18/2025)	€18.04
Naturgy (NTGY.MC)	E (08/05/2024)	€27.50
Orsted A/S (ORSTED.CO)	E (10/07/2025)	DKr 123.95
RWE AG (RWEG.DE)	O (11/29/2019)	€45.69
SSE (SSE.L)	O (11/03/2020)	2,227p
Sarah E Lester, CFA		
A2A SpA (A2.MI)	O (10/31/2025)	€2.43
ERG SpA (ERG.MI)	U (12/11/2023)	€21.42
Italgas SpA (IG.MI)	O (06/25/2025)	€9.35
National Grid plc (NG.L)	O (01/06/2023)	1,170p
Pennon Group (PNN.L)	E (02/21/2025)	499p
Severn Trent (SVT.L)	O (11/04/2022)	2,743p
Snam SpA (SRG.MI)	U (03/16/2021)	€5.69
Terna - Rete Elettrica Nazionale SpA (TRN.MI)	U (12/06/2022)	€8.99
United Utilities Group PLC (UU.L)	O (07/05/2023)	1,187p

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

INDUSTRY COVERAGE: China Energy & Chemicals

COMPANY (TICKER)	RATING (AS OF)	PRICE* (11/17/2025)
Jack Lu		
Bluestar Adisseo Co (600299.SS)	++	Rmb9.68
China Oilfield Services Ltd. (2883.HK)	O (05/08/2023)	HK$8.02
China Oilfield Services Ltd. (601808.SS)	O (10/30/2023)	Rmb14.81
China Petroleum & Chemical Corp. (600028.SS)	E (08/19/2024)	Rmb5.78
China Petroleum & Chemical Corp. (0386.HK)	O (07/29/2025)	HK$4.43
CNOOC (0883.HK)	O (03/17/2021)	HK$22.50
Contemporary Amperex Technology Co. Ltd. (300750.SZ)	O (06/25/2025)	Rmb390.78
Contemporary Amperex Technology Co. Ltd. (3750.HK)	E (10/09/2025)	HK$526.00
EVE Energy Co Ltd (300014.SZ)	E (05/31/2022)	Rmb83.45
Gotion High Tech Co Ltd (002074.SZ)	E (04/17/2023)	Rmb43.00
Guangzhou Tinci Materials Technology Co (002709.SZ)	O (10/27/2025)	Rmb47.59
Hengli Petrochemical Co Ltd (600346.SS)	++	Rmb20.39
Ningbo Ronbay New Energy Technology (688005.SS)	U (10/27/2025)	Rmb35.40
PetroChina (601857.SS)	O (08/19/2024)	Rmb9.87
PetroChina (0857.HK)	O (03/17/2021)	HK$8.85
REPT Battero Energy Co (0666.HK)	E (10/20/2025)	HK$16.40
Rongsheng Petrochemical Co Ltd (002493.SZ)	E (07/29/2025)	Rmb10.90
Shanghai Putailai New Energy Tech Co Ltd (603659.SS)	U (10/27/2025)	Rmb31.62
Shenzhen Dynanonic Co Ltd (300769.SZ)	U (10/27/2025)	Rmb58.38
Shenzhen Senior Technology Material Co (300568.SZ)	O (11/29/2023)	Rmb17.50
Yunnan Energy New Material Co Ltd (002812.SZ)	O (10/27/2025)	Rmb61.87
Kaylee Xu		
Jiangsu Cnano Technology Co Ltd (688116.SS)	U (03/10/2025)	Rmb58.45
Shandong Sinocera Functional Material (300285.SZ)	O (07/25/2024)	Rmb25.21
Shenzhen Capchem Technology Co Ltd (300037.SZ)	E (06/07/2023)	Rmb64.91
Sunresin New Materials Co Ltd (300487.SZ)	E (10/25/2024)	Rmb55.11
Wanhua Chemical (600309.SS)	O (09/17/2025)	Rmb66.38
Zhejiang NHU Co. Ltd. (002001.SZ)	O (08/05/2025)	Rmb25.09

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