



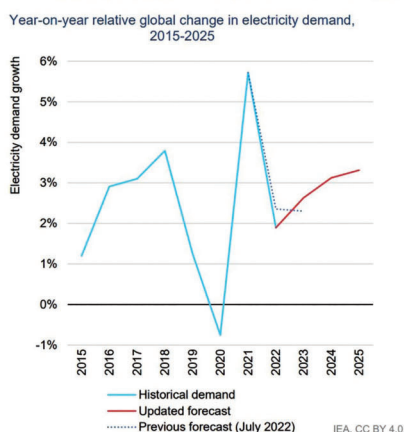
China to consume one-third of the world's electricity by 2025

As the Chinese economy emerges from strict Covid restrictions, the Asian powerhouse is forecast to consume one-third of global electricity supply by 2025, up from one quarter ten years earlier. "China will need more electricity than the EU, the US and India combined," said Keisuke Sadamori, the International Energy Agency's (IEA) director of energy markets and security.

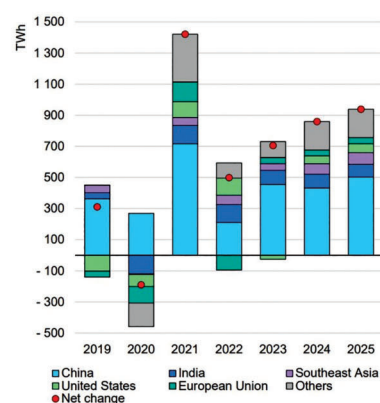
Despite headwinds from the energy crisis, growth in the world's electricity demand is set to accelerate from 2% during the pandemic to an average of 3% over the next three years. The cumulative increase of the world's electricity demand of about 2 500 TWh out to 2025 is more than double Japan's current annual electricity consumption, Sadamori pointed out.

More than 70% of the rise in demand will come from China, India and Southeast Asia, analysts reckon. China leads in terms of absolute growth, up 58 TWh per year through to 2025, while India will have the highest percentage growth (+81%), followed by Japan, IEA modelling shows.

Out to 2025, more than 70% of the growth in global electricity demand is set to come from China, India and Southeast Asia combined



Year-on-year change in electricity demand by region, 2019-2025



EU electricity demand contracts

In contrast, electricity demand in the EU contracted in 2022 due to an unusually mild winter and as industry scaled back production because of high energy prices and supply disruptions caused by Russia's invasion of Ukraine. The 3.5% decrease in EU demand was its second largest percentage decline since the global financial crisis in

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Germany to tender large capacities of H2-ready gas power plants

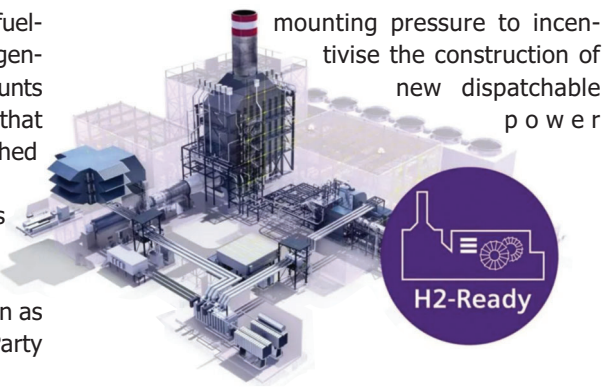
The German government will put a huge number of new hydrogen-ready gas-fired power stations and other backup capacity out for tender this year, all aimed to start operations by 2030. "Planning and auctioning needs to start now," economy minister Robert Habeck stressed, though he admitted it may take five years to find proper locations for the plants.

To accelerate the transition from fossil fuel-based energy to wind and solar power generation, Germany needs substantial amounts of "molecule-based" backup capacity that will not run continuously but will be dispatched primarily to stabilise the grid.

"The capacities we need today when there's weak wind and no solar power to supply energy need to be set up based on conventional power plants – gas for the time being, but then as quickly as possible, hydrogen," the Green Party economy minister explained.

Beware lengthy lead-times

Considering the lengthy lead-times for commissioning new capacity, amid the planned coal and nuclear phase-outs, the government had faced



Render of hydrogen-ready power plant

stations. Though it might take five to seven years to find suitable locations and get planning permission for these plants, Habeck is confident that now is the right time to "issue contracts" with a view to

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2009, with the largest being the exceptional contraction due to the Covid shock in 2020.

Falling gas-burn in the EU offset by Middle East growth

Sharp spikes in gas prices and in turn soaring electricity prices in some markets, particularly in Europe, have ignited a political debate over reforms to power market design. Gas-burn in the European power sector is forecast to fall as the green energy transition progresses, but significant growth in the Middle East is set to partly offset this decrease.

Advanced economies, notably in the EU, are seeking to expand renewables and green fuels to displace fossil fuels in sectors such as transport, heating and industry. The share of renewables in the global power gen mix is forecast to rise to 35% by 2025, up from 29% last year, as the shares of fossil power gen falls.

Europe temporarily bucked the trend away from fossil power last year as drought curtailed hydropower output and technical issues caused widespread closures of French nuclear power plants. But analysts stressed

this setback will be temporary, with EU power gen emissions seen to fall by about 10% a year on average through 2025.

Declines in coal-fired generation in Europe and the Americas are likely to be matched by a rise in the Asia-Pacific region, despite nuclear power restarts in Japan. Developments in China, where more than half of the world's coal-fired generation occurs, will remain a key factor, IEA analysts said. Energy-related CO2 emissions are hence set to remain around the same level through 2025. ■

Gas prices in US power sector nearly triple between 2020 and 2022

Prices for natural gas as a fuel in the US power generation sector nearly tripled to \$7.00/MMBtu on average in 2022, up from \$2.40/MMBtu two years earlier. Rising fuel prices made the electric power sector account for 31% of total gas spending and accelerated the build-out of renewable energy sources, which have very low operating costs.

Gas prices vary significantly by region, though they have been rising in all US states. In Oklahoma, for instance, gas prices for power generation were more than five times higher in 2021 than in 2020. In Texas, Kansas, New Mexico, and Arizona, they were more than three times higher.

In consequence, gas-burn in the power sector fell due to higher prices. Once exception was North Dakota, where gas consumption increased by 26% due to higher use by the industrial sector along with rising regional gas production.

Capacity additions dominated by solar and batteries

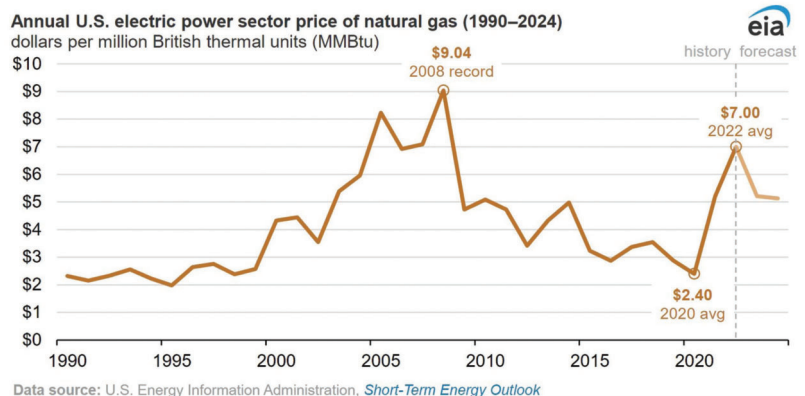
Comparatively high fuel prices for gas-fired power stations made investors turn to utility-scale solar, whose technology costs are in rapid decline. Developers plan to add 54.5 GW of utility-scale power generation capac-

ity in the US in 2023, with more than half (54%) derived from solar, the government's Preliminary Monthly Electric Generator Inventory shows.

Though the solar build-out accelerated since 2010, additions plunge by 23% in 2022 largely due to supply chain disruptions caused by the pandemic. Analysts at the US Energy Information Administration (EIA) expect that some of those delayed 2022 projects will begin operating in 2023, when developers plan to in-

stall 29.1 GW of solar power in the United States.

Natural gas-fired generating capacity comes third in line of all planned additions, behind battery-based energy storage. Developers envisage 7.5 GW of new gas power capacity with 83% of this derived from new combined-cycle plants. ■



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get the plants into operation by the turn of the decade.

Installed gas-fired power gen capacity currently stands at 33.2 GW, according to the Federal Network Regulator (BNetzA). In addition, there is 35.8 GW of hard and lignite coal-fired capacity but this is legally required to be phased out by 2038, with the Green Party pushing for an earlier coal exit by 2030.

Avoid a subsidy competition

Rebuking calls to reverse Germany's nuclear exit, Habeck said this would risk to deter investors in renewables and other energy transition technologies. Green power companies needed "guarantees that they will receive orders," Habeck said, which the

government could end up providing but the minister warned this should not amount to a "subsidy competition" with other countries, particularly with the United States and its Inflation Reduction Act (IRA).

Gas to fuel the new hydrogen-ready power station will mostly be sourced from Norway or shipped to Germany in the form of LNG, before hydrogen will become available in sizable volumes. While gas has for long been considered as a "bridge technology" towards renewable power, Russia's war in Ukraine and the ensuing energy crisis has made the German government speed up the build-out of renewables and energy storage and target to double electrolysis capacity by 2030. ■

Belgium to double gas transit to Germany, study second power cable

The Belgian Prime Minister Alexander De Croo has agreed to double gas transit to Germany, evaluate the construction of a second electricity interconnector and link the countries' hydrogen networks. LNG, imported via the Belgian import terminal in Zeebrugge, plays a key role in meeting Germany's gas demand and ensuring affordable energy supply to avoid deindustrialisation.

Until recently, Germany had no infrastructure to import LNG – hence shipments via Zeebrugge were vital to make up for the missing Russian supply through the Nord Stream 1 and brotherhood pipelines. But even after the start-up of the three floating LNG terminals off the German coast in Wilhelmshaven, Brunsbüttel and Lubmin, Europe's largest economy will still be relying on imports via Belgium for some time.

De Croo met with the German Chancellor Olaf Scholz in Zeebrugge where the two heads of states vowed to cooperate to strengthen Europe's energy independence and secure the future of Belgian and German industries. Access to affordable energy, financing and innovation is crucial to achieving this objective, the Belgian PM pointed out.

Plans for second interconnector

In terms of electricity, Belgium and Germany are currently linked by one energy interconnector that was built in 2020 — ALEGRO.



Fluxys' Zeebrugge LNG terminal

But following the meeting of De Croo and Scholz the power grid operators Elia and Amprion are expected to embark on a feasibility study for a second power link. The new interconnector could have a capacity of 1 gigawatt HVDC and be operational as early as 2028, according to a project plans submitted to the European Network of Transmission System Operators for Electricity (ENTSO-E).

At a press conference, the Belgian PM underlined that "it makes sense when your industries are linked that your energy infrastructure is also linked." ■

US gas futures near 25-month low despite return of Freeport LNG

Natural gas futures in the US for March delivery have rebounded to \$2.448/MMBtu on Tuesday, up from \$2.405/MMBtu a day earlier, as shipments from the long-idled Freeport terminal resume. A cargo was picked up late on Sunday and the second one is being loaded but analysts do not expect Freeport LNG to return to full capacity until mid-March.

Freeport, the second largest US LNG export terminal, had to be shut down after a fire in June 2022. The operator, which began producing LNG in one of the terminal's three liquefaction trains, has filed to federal regulators for permission to restart full commercial operation at the plant.

But the US Pipeline Hazardous Materials Safety Administration (PHMSA) said it would still take "several months" for Freeport to fully ramp up and to bring all processing Trains and other facilities on stream. Five or six LNG tanker are at anchorage near Freeport LNG, sparking speculation about an imminent restart.

Feedgas flowing to Freeport for liquefaction has resumed but is still at a tiny fraction of the 12.9 Bcf/d the terminal pulled in in March 2022, when running at full capacity. So, the terminal's impact on overall US gas demand and prices is minor, but government analysts expect prices to strengthen towards the end of the first quarter. ■

CNPC gets close to seal mega-LNG deal with QatarEnergy

China National Petroleum Corp (CNPC) is understood to be close to purchasing large quantities of LNG from QatarEnergy over nearly 30 years, similar to the deal struck by Sinopec in November. Sinopec agreed to offtake 4 million tons of LNG from Qatar's North Field expansion over 27 years, insulating China from gas price volatility as its economy recovers.

If signed, it would be the second large offtake accord between Qatar and the world's second largest LNG buyer as China aims to source more natural gas to replace coal in the power sector and re-

duce carbon emissions. Traders noted the deal would secure long-term supply from a reliable exporter and optimise imports between China's state-owned energy majors.

"Long-term deals are important for both seller and buyer," QatarEnergy chief Saad al-Kaabi said with reference to the Sinopec offtake SPA that will last into the 2050s. In addition to the gas offtake, Sinopec entered an "integrated partnership" with QatarEnergy, which gives the Chinese major the option to buy a stake in the North Field expansion project.

North Field is part of the world's largest offshore gas finds that Qatar shares with Iran, which calls its share South Pars. The overall field is estimated to hold over 51 tril-

lion cubic meters of natural gas and some 50 billion barrels of gas condensate.

The North Field Expansion, carried out by QatarEnergy in joint ventures with Total, Eni, ExxonMobil and ConocoPhillips, includes plans for six new LNG trains, designed to boost Qatar's liquefaction capacity from 77 million tons to 110 million tons in three years. The massive project will cost Qatar and partners nearly \$30 billion – hence long-term offtake is vital to guarantee a stable rate of return. Following from the North Field East expansion project, QatarEnergy wants to also pursue the North Field South expansion that would ramp up the company's total liquefaction and export capacity to 126 mtpa by 2027. ■



Qatar's North Field East LNG venture

Costs of green H2 to halve by 2030, reach similar level as its blue rival

Blue hydrogen (H₂), made from natural gas through steam reforming, is currently the cheapest option to meet rising demand considering it costs \$1.5 to \$3 per kilogram. But as renewables energy becomes more widespread, the cost of green hydrogen via electrolysis is forecast to halve from \$6 to \$3/kg – on par with its blue rival, GEFC analysis finds.

The Gas Exporting Countries Forum (GEFC) expects both blue and green hydrogen will become viable options for use in various industries. The notion is that although renewable energy and green hydrogen will become cheaper, the cost for blue hydrogen is also set to fall as the technology for CCS improves. The

"The energy transition is not a one-size-fits-all solution, and a variety of clean hydrogen production methods are necessary to meet the future energy needs," GEFC energy technology analyst Seyed Mohsen

Razavi stressed.

Modelling an accelerated energy decarbonisation scenario (ADES), shows that hydrogen demand could reach 550 million tonnes by 2050, making up nearly 10% of the total energy mix. "This high demand highlights the need for more efficient production methods," he underlined.

Electrolysis of water, using renewables power, is expected to gain 48% of the hydrogen output by 2050, with 270 million tons of production. But achieving this output level will require around 12,000 TWh of

electricity – four times the electricity generated from wind and solar today, or the total power output of the US and China combined. Moreover, electrification of energy sectors and transport could push the need for electric power generation from wind and solar to 46,000 TWh by the middle of the decade.

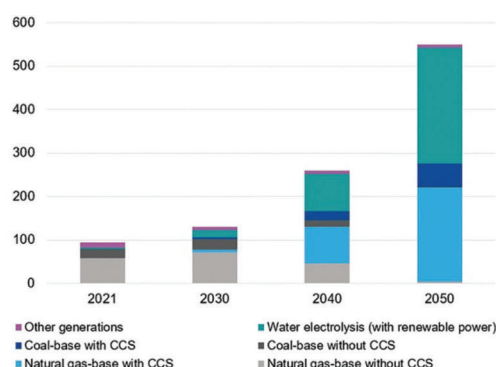
Need for H₂ produced from 'mature methods'

"The need for such a large amount of renewable power makes it imperative to consider a large share of hydrogen production from other available, competitive and mature methods, such as natural gas-based blue hydrogen," Razavi commented.

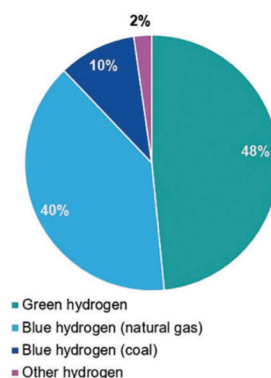
The AEDS scenario expects that around 220 million tons of hydrogen will be generated using natural gas with carbon capture and storage (CCS), accounting for 40% of total output by 2050. This level of hydrogen production will require more than 930 billion cubic meters of natural gas by 2050.

Coal gasification with CCS, meanwhile, is expected to contribute to around 10% or 54 million tons of hydrogen production by 2050. ■

Hydrogen output by method of production in AEDS (Mt of H₂)



Technology share in hydrogen production in AEDS in 2050 (%)



Los Angeles approves conversion of Scattergood CCGT to hydrogen

The Los Angeles city council has unanimously voted in favour of converting the 850 MW Scattergood combined-cycle gas power station to green hydrogen. The plant operator LADWP can now launch a tender for converting Units 1&2, for starters. The 346 MW repowering project will cost an estimated \$800 million and is due completed by the end of 2029.

Los Angeles Department of Water and Power (LADWP) said is preparing to start a competitive bidding process for design, engineering, procurement, and construction, testing and com-

missioning of Scattergood's first two units under the so-called Green Hydrogen-Ready Modernization Project.

Situated in the Playa del Rey area of Los Angeles, Scattergood has been a stable power source for California's largest metropolitan area. According to project filings, LADWP wants to install fuel-flexible combustors at the two units that can burn large volumes of hydrogen which will also require changes in fuel handling systems, valves and pipelines. A full shift to green hydrogen would help the plant operator LADWP to transi-

tion to 100% renewable energy by 2035.

Built in the late 1950s, Scattergood originally consisted of three steam turbine generators that burn natural gas in boilers. To meet air and water quality standards, Scattergood Unit 1's capacity was lowered, while Unit 3 was replaced by a more efficient combined-cycle generator. In addition, two smaller, simple cycle gas turbines were built. The new turbines, known as Units 4, 5, 6 and 7, have a total generating capability of 534 MW.

Critics argued the hydrogen volume required to fuel Scattergood would require more than 122 million gallons of water. Others are concerned that the \$800 million price tag to convert the plant might easily increase to \$1 billion – money that might be better spent on wind and solar power resources. ■



Site of Scattergood repowering project

Ansaldo seals contract for four AE94.3A gas turbines with Azerenergji

Italy's Ansaldo Energia has confirmed the signing of a contract, worth over €160 million, with Azerenergji for the delivery of four AE94.3A gas turbines to be installed in a combined-cycle power plant in the Azeri city of Mingachevir. The AE94.3A gas turbine produces 340 MW of electrical power, with an efficiency of 40.3% in standard conditions.

Use of Ansaldo's the high-efficiency combined-cycle technology is expected to save about 1 Bcm in gas fuel per year at the Mingachevir CCGT, the President of Azerbaijan President Ilham Aliyev noted at the plant's ground-breaking ceremony. The power project, with a generating capacity of 1,280 MW is the largest of its kind in Azerbaijan's

independence period.

The four AE94.3A gas turbines – a historical product with over 4 million operating hours – will be installed as an additional combined-cycle plant at the "Azerbaijan" power plant Mingachevir, which has recently been refurbished.

Ansaldo's plant concept is to use two gas turbines for each steam turbine, which significantly increases efficiency and lowers gas consumption. The Italian turbine maker has installed 80 combined-cycle power units and 16 open-cycle units in 16 countries worldwide.

Giuseppe Marino, CEO of Ansaldo Energia expressed pride for the company to have been chosen in this important energy project in Azerbaijan – "a market full of

potential," he noted, hinting at the importance of Azerbaijan for gas supplies to Italy.

Italy started to import natural gas from Azerbaijan in 2021, following the completion of the Trans Adriatic Pipeline (TAP). A drastic reduction in contractual gas supplies from Russia's Gazprom over sanctions in connection with the Kremlin's war in Ukraine made Italy seek to step up imports from Algeria and Azerbaijan, which exported roughly 10 Bcm to Italy in 2022. ■



View of the refurbished Mingachevir power station

Capenhurst battery starts up, lowers National Grid's balancing fees

Zenobē Energy's Capenhurst battery energy storage has begun delivering reactive power to the British electricity grid, based on an innovative contract. Situated in Chester, the 100 MW/107 MWh battery reduces the curtailment of wind energy in the Mersey region and lower National Grid's need pay for balancing payments for turning off wind farms and ramping up gas peakers.

In December alone, National Grid had to pay £82 million to wind power generators which were cut off when their produced electricity exceeded the power network's hosting capacity. Zenobē claims its battery will reduce the need for such curtailments and save the TSO up to £58 million.



Zenobē's Capenhurst BESS in Chester

Nine-year contract

The rapid uptake of renewable energy supply, particularly from offshore wind, has increased National Grid's demand for reactive power to help manage voltage levels. In a competitive tender, launched by the British TSO, Zenobē won a nine-year contract to deliver 40 MVar of reactive power to the grid in May 2020 – the first time a battery has been contracted to deliver such services. ■

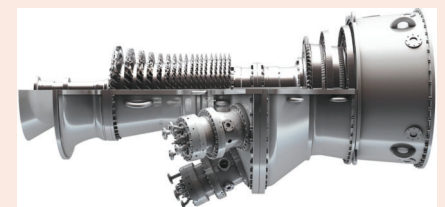
Apart from reactive power, the 100 MW battery also supplies active power services that run concurrently. The battery's direct connection onto the 275Kv bay enabled tacking of multiple active power, capacity and voltage services to deliver the low-cost electricity to the consumer, the developer explained. Over the next 15 years it is forecast to remove 1,004,040 tonnes of CO₂ compared to traditional power generation sources. ■

GE turbines for CHP in Kazakhstan

Aksa Energy, the largest listed power producer in Turkey, has ordered two GE 6F.03 gas turbines for its 240 MW combined heat and power (CHP) project in Kazakhstan, due operational in 2025. The ageing energy infrastructure of the Central Asian nation is heavily reliant on coal, so the new flexible CHP will balance renewable energy to help Kazakhstan decarbonise.

The new 240 MW CHP in Kyzylorda will be the first CHP to be built and commissioned in Kazakhstan. "We chose GE's technology based on the evaluation of multiple parameters such as CAPEX, OPEX, performance, delivery cycle, reliability, service as well as flexibility to meet grid operator requirements," Aksa Energy vice chairman Korkut Ozturkmen said.

6F.03 turbines are known for their flexibility, turndown, and fuel performance. They draw on the best of GE's scaled H and F-Class technology, offer quick installation and have a large and diversified installed base across approximately 40 countries, with more than 200 of these units in operation globally. ■



GE 6F.03 gas turbine

Battery storage “almost ready” to play the flexibility game

Variable renewables could make up more than half of global capacity additions to 2040, so affordable energy storage is vital to provide flexible supply and grid inertia. Analysts say the cost for four-hour batteries will fall to \$220/kWh by 2040, spurring a storage rollout of nearly 220 GW.

Global power demand is set to grow over 20% over the next decade, according to the International Energy Agency's (IEA) New Policies Scenario (NPS), while flexibility – the ability of the power system to quickly adapt to changes in power supply and demand – grows by some 80%.

Storage allows for higher overall utilisation of power generation assets, which lowers the risk of system and provides higher average revenues through enhanced flexibility. IEA analysts hence call flexibility “the cornerstone of future electricity systems.” In the NPS scenario, battery storage and demand-side response are forecast to contribute 40 GW by 2040.

Most newly deployed batteries will be paired with solar PV and wind power as they increase their dispatchability. For operators, these hybrid renewables plus storage installations allow revenue stacking from energy arbitrage and ancillary services offered to the grid.

Long-duration battery types evolve

But battery storage is still at an infancy stage, with around 4 GW installed compared to 153 GW of pumped hydro storage worldwide. The modular nature of battery storage technology allows for a wide range of application. Moreover, falling costs for lithium ion batteries have led to a tripling of

installations over the past three years. Lithium ion batteries, aimed at providing short-term storage, now account for just over 80% of all battery capacity.

For longer storage durations, battery types based on sodium sulfur and flow batteries are gaining interest, according to IEA findings. Hybrid installations, e.g. off-grid solar plus small-scale batteries, are also making inroads and gain competitiveness with small fossil gensets in a decentralized power system.

Main provider of peaking capacity by 2040

With second-use batteries from the transport sector already widely available, the IEA reckons that if cost reductions achieved in car batteries would spill over into power sector applications this will lead to utility-scale battery pack costs fall to around \$100 per kWh by 2030.

A large number of batteries can be repurposed after use in an electric vehicle for a second life in grid-scale applications in the power sector. Recycling batteries can lower costs and will give a further boost to the competitiveness of battery storage.

Under these assumptions, IEA analysts expect cost reductions will lead to batteries being 70% less expensive than today by 2040, and to battery storage becoming more competitive than alternative options for flexibility earlier than in the NPS. This would translate into 540 GW of batteries installed

NEWS NUDGES

Conrad advances 15 MW battery in Somerset

Conrad Energy has been granted planning approval for a 15 MW battery site in Somerset, UK. The battery unit, consisting of 15 energy storage containers, is due operational by the end of 2024.

Semcorp opens large energy storage

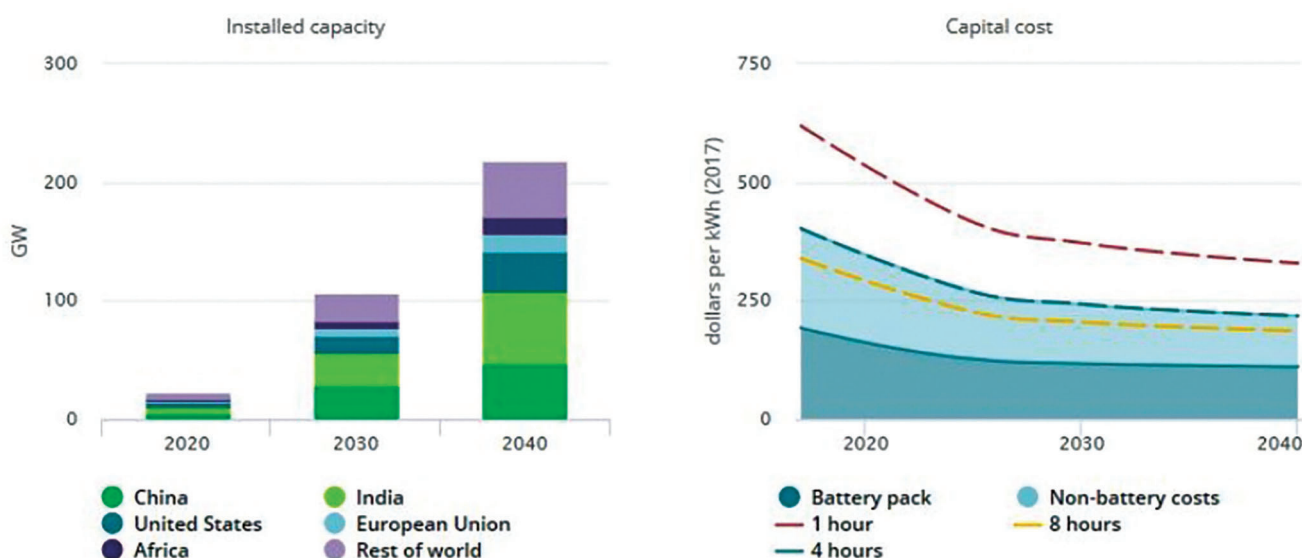
Singapore's Sembcorp Industries has opened southeast Asia's largest energy storage system on Jurong Island. The utility-scale ESS has a maximum storage capacity of 285 MWh and can meet the electricity needs of around 24,000 four-room households for one day, in a single discharge. Its rapid response time is essential in mitigating solar intermittency in Singapore's fast-changing tropical weather.

US power gen slides

Electricity generation in the US is forecast to fall by 2% in 2023 as the real GDP contracts slightly in the first half of this year. Come 2024, however, the electricity output is expected to rebound by 2% while the power gen mix shifts from coal to renewable energy sources, backed up by flexible gas gensets and energy storage.

by 2040, reducing gas turbines by 100 GW and making battery storage the main technology for peaking capacity by 2040. ■

Deployment and costs of utility-scale battery storage systems in the New Policies Scenario



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